Railway Mechanical Engineer

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The master workman uses great care in selecting his tools and keeping them in first-class condition. The officer or foreman is judged by the results he gets from his organization or the particular part of the organization over which he has control. He must constantly study to improve his ability and to exert a higher type of leadership. He needs good tools just as does the mechanic, but they are naturally of a very different sort. Among his tools are a knowledge of the right principles of dealing with the human element, of the best methods and practices of doing work over which he has supervision, and the best types of facilities and equipment for use in his department. Progress is continually being made in all these matters. It is no small task to keep up with this progress, even for a foreman who has a comparatively limited part of the organization under his direction. It requires constant study and a knowledge of what is being done by others in the same class of work. The *Railway Mechanical Engineer* is specially designed to meet these needs of railway mechanical officers and foremen.

Using the Railway Mechanical Engineer

It is not easy for the average man to read or study books or technical publications, but nevertheless it is vital for him to do so if he expects to advance or even to hold his own if he is in a supervisory position. The men at the head of an organization or a department have a grave responsibility in seeing that those associated with them are properly encouraged and inspired to develop and make better use of their peculiar talents. One of the contributors to this number, whose letter is included in the article on the "Bill Brown-Top Sergeant" controversy, speaks feelingly of the lack of encouragement which he received from his superiors in this respect. Is there not here a lesson for every man holding a supervisory position, even though he is only a gang foreman? In the latter case there are quite likely to be ambitious men or young men working for him who are sadly in need of a bit of help and encouragement in getting a larger appreciation of the possibilities which lie before them and the best ways in which to prepare themselves to make the most of their opportunities.

One of the men quoted in the article on the "Bill Brown-Top Sergeant" controversy pokes fun at "Bill Brown" because of the statement that he made in commenting upon the necessity of reading the *Railway Mechanical Engineer,* and the Railway Age, that "the advertising columns alone are an education." It seems hardly necessary to comment upon this statement and yet our attitude might be misunderstood if we allowed it to go unquestioned. There was a time not so many years ago that the advertisers used only small space, seldom changed their copy and the advertising pages were little more than a directory. Today, however, many of the advertisers spend much time and money in securing accurate data and illustrations to show the working and advantages of their products, change the copy with each issue and use large spaces, that it may be effectively displayed. We have received many letters from readers of the *Railway Mechanical Engineer*—including three railroad presidents within recent months—commenting on the practical information contained in the advertisements and their helpfulness and value. In other words, "Bill Brown's" statement is typical of a large number of similar expressions which have come to us unsolicited. Sometimes, indeed, the editors have been a bit embarrassed because they have been informed that some of the readers, at least, turn first to the advertising pages when they take the wrappers off their copies.

Our advertising pages

The average mechanical department officer is perhaps more apt to consider his job as one primarily concerned with machines, material and men, taken in the order named, than anything else. It is an inspiration, however, to get another view, in which this order has been reversed, which was brought out in a talk made by the head of the mechanical department of a large western railroad at a meeting of his staff a number of months ago. In his remarks the ideal of rendering service was specially emphasized and we can do no better in passing this ideal along to others than by quoting directly a portion of his talk which is as follows:

The task of the mechanical department officer

"The most fundamental task of the officer in charge is to awaken, without any semblance of personal self-gain, an interest in and a desire for knowledge and self-development in those he has jurisdiction over. In considering this question, the officers in charge of this department are chiefly concerned in dealing with and studying this subject with respect to incentives, rewards, jealousies, rivalries, discontents, loyalties, ambitions, and aspirations. Our vice-president is primarily concerned in determining motives, intentions and responsibility. Our president is primarily concerned with relative values and the means to make real the highest values in each of us, . . . with a single motive in mind: the good of the great transportation system we are privileged to serve. When all is said and done, we cannot accept any account, any description or explanation of our combined effort which leaves out of the picture this all important aspect that we call impulse, desire, striving towards a goal. . . . Let our aim for the future be one of enlarged viewpoint, free of every small and selfish contact with only one purpose in mind to render as nearly perfect a service as possible, based on the highest principles of attainment in every respect.

"No man can be so much of a man, in any one direction,

as when he is a whole man in that direction. The fellow who can concentrate his whole being, all his energies and all his capabilities, for the compassing of the one thing on which his mind is fixed, is obviously more effective, in behalf of that object of his endeavor, than would be possible were his energies divided, and were only a portion of himself given up to that for which he is striving. And this power of concentration is that which makes the pre-eminent practical efficiency in any sphere of human endeavor."

This idea of the fundamental task of the mechanical department officer is old in many respects, but we find it presented here from a new angle. Its application, however, is not necessarily limited to the mechanical department. Any man who has charge of the work of other men can profit by the suggestion—first of all, aim to render service and finally know how to concentrate.

A bundle of sticks

Many years ago, the father of several sons, calling them before him shortly before his death, is said to have presented to them a bundle of sticks snugly bound together and to have asked each in turn to break them. Each in turn failed. The father then, removing the bond which held the bundle together and taking the sticks one at a time, broke all of them. This simple object lesson, presented to show the importance to the sons of maintaining family unity, is suggestive of the importance of unity and cohesion in many other situations and, perhaps, in none more than in the mechanical department budget for capital expenditures. A budget made up of numerous unrelated items for a new machine tool here, a new ash pit there and the extension of a few roundhouse stalls elsewhere may be compared to the sticks in the bundle after the cord which bound them had been removed. Each item must be defended separately and no matter what possibilities it offers for savings in the unit costs of detail operations, it is extremely difficult to prove its indispensability. On the other hand, a budget which represents a well-considered plan, perhaps looking a decade into the future as well as considering the immediate needs, carefully co-ordinated and spread over a period of years, at the end of which a definite reduction in the maintenance cost per locomotive or car-mile may be expected, the aggregate of which will show in improved net operating income, provides each item with the support of all of the others, just as each of the sticks in the bundle added to the strength of all of the others. A ten million dollar plan, for which results may be predicted in terms which mean something to the executive, is stronger than a succession of one hundred thousand dollar budgets each made up of poorly correlated items, the savings from one of which are large enough to be found when carried through to net operating income.

What are your machine tools doing?

The mechanical department of an eastern railroad has just completed the installation of new machine tools and equipment in nine of its shops. The past record of this road bears out the statement of the department head that "the procurement of this new equipment is in line with the well established practice of this road to retire equipment as it becomes inefficient and obsolete, and to replace it with modern, up-to-date equipment." He also says that, "the shops on this road are operated on a piece-work basis and the system is such that it quickly develops any inefficiency in machine tools." Our attention is called to a new 90-in. journal turning and quartering machine installed in a locomotive repair shop. Previous to the installation of the new machine, an old driving wheel lathe that had been altered and reassembled was used as a journal turning lathe. The work done on this old machine was generally unsatisfactory and expensive. The output of the machine was limited and quite often the shop management found it necessary to allow journals and crank pins to remain in service that should have been reconditioned. The fact that the shop was not properly equipped to turn journals and crank pins and keep them in proper quarter often resulted in locomotives being sent out of the shop in unsatisfactory condition, necessitating increased expenditure for repairs at the enginehouses and resulting in unsatisfactory performance of the locomotives on the road. The new machine will keep the journals and crank pins properly trued up and in quarter on all the locomotives that go through this shop, which has an output of approximately 30 locomotives a month.

Proper and adequate records of the production of all your machine tools will show when a tool is failing to meet requirements. To keep a machine tool in service that retards shop production or with which it is impossible to do the right kind of work is an expensive investment for any road. It pays to know what your machine tools are doing.

Help the younger men

One cannot but be impressed by the remarkable changes that have taken place in the railway mechanical field during the past decade. It is difficult even at this time to understand the full significance of these changes or to see them in their proper perspective. Have some of these developments made us lose sight of the necessity of helping and training the younger men to prepare themselves for the larger responsibilities which they must assume in the future? Industry and transportation have been growing at an extremely rapid pace and the problems of organization have been becoming more and more complicated. There is every sign, indeed, that these problems will continue to increase in number and extent with the continued growth of the railroads and under economic pressure. This will require much bigger and better trained men in the future, not alone in supervisory positions, but among the workers as well. Are we doing all that we should to discharge our responsibilities in this matter?

It may be well to review briefly some of the general movements under way to provide better trained men and better leadership for the future. Modern apprenticeship, inspired in this country by George M. Basford and typified by the methods in vogue on the Santa Fe and the New York Central, has gradually been receiving the support of more and more mechanical department officers and a considerable number of roads are now following approved practices in this respect. Unfortunately many roads have failed to face to this question in a big way. Even on roads where the best apprenticeship methods are being followed; however, it is important that broad-gage, big-hearted officers and men should stand ready to help and encourage the young men as individuals to recognize their opportunities and to persist in studying to improve themselves. A friendly word or a pat on the back will often go a long way in putting new energy into young men who naturally sometimes grow discouraged in their work.

During the latter part of this month there will be held in Pittsburgh the third of what have become known as Younger Railroad Men's Conferences. These have been held under the direction of the Railroad Y. M. C. A., the purpose being to gather together annually for a three-day conference representative young men from different departments and different railroads in this country and

Canada. The aim is to get the younger men to recognize the importance of the railroads in our economic, social and political structure and the opportunities in this field. The fact that a strong man must be properly balanced, is presented to them in the four-fold program of the Y. M. C. A. Then, too, with the help of practical railroad officers, an effort is made to have the boys check up to see that they are in the particular branch of railroading that they are best fitted for and as to how they may best prepare themselves for advancement. The boys, on the basis of former conferences, will go back to their home towns and will help their fellows grasp the spirit of the conference and profit from it in a practical way. Then, too, these conferences in many cases have opened the eyes of railroad officers to their responsibilities and opportunities in encouraging young men and helping them to find their proper places in the organization.

That these things appeal to the practical, hard-headed railroad officer is indicated by the fact that several of the railroad clubs have inaugurated "Younger Men's Nights." Few meetings of the New York Railroad Club have attracted so great attention, for instance, as the one last month, at which seven young men from as many different railroads and as many different occupations, gave 12-minute talks in which they told something of their experiences and problems, as well as what they conceive to be the opportunities in their particular work. From these it was clearly evident that these young men are not expecting favors, but that they recognize that they must make good by hard work and real ability. What they do ask, however, is that a reasonable effort be made to give them the right kind of information and training and to help them gain a larger appreciation of what the railroads mean and how they, as individuals, can render the largest degree of service.

New Books

PROCEEDINGS OF THE INTERNATIONAL RAILWAY FUEL ASSOCIATION, 1925. *Edited by the Treasurer, J. B. Hutchinson, 1809 Capitol avenue, Omaha, Neb. 526 pages, illustrated. Price* $3.00.

This book contains the proceedings of the seventeenth annual convention of the International Railway Fuel Association which was held in Chicago, May 26 to 29, 1925. The reports submitted include boiler feedwater heaters; front ends, grates and ash pans; stationary plants; Diesel locomotives; fuel stations, and firing practice. The book also contains the following papers which were read before the convention by men in the railroad field interested in fuel conservation: Signals and the saving of fuel; How can the railroad management effect fuel economy? How can fuel purchases effect fuel economy? The development of oil burning practices on locomotives; Fundamental fuel factors; How can a mechanical officer effect fuel economy? Back pressure as an index of fuel economy, and the N. A. P. A. coal chart.

THE AIR BRAKE ASSOCIATION PROCEEDINGS, 1925. *Edited by the secretary, F. M. Nellis, 165 Broadway, New York. 350 pages, bound in leather.*

The proceedings of the thirty-second annual convention of the Air Brake Association which was held at Los Angeles, Cal., May 26-29, 1925, is the testimony of what a railway association can do in the way of constructive work through proper committee organization. The book contains an unusual amount of practical information which is due largely to the manner in which the various committees and air brake clubs handle their reports and papers. The subjects discussed at this year's convention covered practically all phases of air brake work. The reports submitted covered: What is the best material for air brake and air signal piping? Passenger train handling; Graduated release; Condemning limits of A. R. A. standard triple valve parts; What are you specifying and what are you getting in foundation brake rigging on car equipment? Brake pipe leakage; More efficient air compressors; Recommended practice; Triple valve slide valve, leakage indicator; and Automatic train control. The reports of the secretary, treasurer and various committees are also included.

PRINCIPLES OF LOCOMOTIVE OPERATION, *by Arthur Julius Wood, professor of mechanical engineering, The Pennsylvania State College. 315 pages, illustrated, 6 in. by 9¼ in. Bound in cloth. Published by the McGraw-Hill Book Co., Inc., New York. Price,* $3.00.

The first edition of this book, which was published under the title of the "Principles of Locomotive Operation and Train Control," has been used quite extensively as a text book in technical schools and as a reference book by many railway mechanical department officers. This, the second edition, is a worthy successor of its predecessor for the author has included in its revision the most recent developments, both theoretical and practical, in the design and construction of the steam locomotive. Prof. Wood has shown the locomotive as a power plant to which the maximum possible amount of energy in the fuel should be available at the drawbar. The application of the laws of mechanics and thermodynamics are brought out by a number of practical examples which point the way to a solution of the more involved problems in proportioning and design.

It is well for those who are being initiated into the mysteries of the locomotive to consider at the outset the application of the fundamental laws of mechanics as applied to locomotive design and operation. Hence, the book begins by defining the purpose of a locomotive in terms of these laws. The purpose of a locomotive is to do work. Work is the overcoming of resistance through space and is, therefore, the product of the two quantities; namely, a force, and the distance through which the force acts. The utilization of heat energy for the performance of useful work and the various changes through which it must go in order to perform useful work at the drawbar, are discussed in the introductory chapter. The author's method of handling these fundamentals of locomotive design and operation cannot help but refresh the mind of the student who has already studied his thermodynamics and mechanics.

Railway mechanical department officers will find this book to be a valuable addition to their reference libraries. The arrangement of the book is such as to provide quick access to information on the various subjects incidental to locomotive design, construction and operation. A list of the chapter headings and a few of the sub-divisions in each chapter will give the reader some measure of the thoroughness with which the author has covered the subject. These are as follows: Principal Types of Locomotives; Determining the Tractive Force for Two and Three-cylinder Locomotives; Acceleration of Trains; Train Resistance; Effect of Air and Temperature on Resistance; Curve Resistance; Speed-Time Curves as Applied to Locomotive Performance; Dynamometer Cars and Tonnage Rating; Air Brakes and Brake Rigging; Combustion and Fuel Economy; The Formation and Action of Saturated and Superheated Steam; Valve Motion; Locomotive Ratios or Factors; The Proper Selection and Use of Locomotive Ratios; Counterbalancing; Locomotive Testing; Modernizing the Locomotive. The book also contains an

appendix in which is given a number of convenient tables for use in design and calculation.

The chapter on tractive force includes a discussion of the effect of inertia of reciprocating parts, and the effect of speed on the tractive force developed by a locomotive. In showing the development of the Kiesel formula for calculating the cylinder tractive force for saturated locomotives, the author has supplied constants that may be substituted in this formula when determining the tractive force of superheated locomotives. These constants are intended to eliminate the usual difficulty encountered in determining the true average rate of evaporation and the effect of the superheater surface. This chapter also discusses the various factors entering into the calculation of the tractive force for three-cylinder, four-cylinder compound, Mallet four-cylinder compound, and for locomotives equipped with boosters.

In the revision of the text, a number of problems have been added on the design of foundation brake rigging, a discussion of the time lost in slow-downs and descriptions of the latest developments in stokers, feedwater heaters, brick arches and boosters. There is also included a method for laying out a Walschaert valve gear; factors and ratios for empirical design; a discussion of the theory of steam locomotive development; calculations for counterbalancing, and a discussion on modernizing the locomotive. The chapter on the formation and action of steam has been entirely rewritten and includes the most recent data on boiler performance.

While intended primarily for use in technical schools, this book furnishes railway engineers and officers interested in locomotive design and operation a concise review of the theory on which certain problems in locomotive design and construction are based. In revising and bringing up-to-date his original work, the author has fulfilled the wishes of many mechanical department officers.

What Our Readers Think

Locomotive efficiency—Past and present

Galveston, Tex.

To the editor:

I have been quite interested in reading the editorial entitled "Locomotive efficiency improves," in the September issue of the *Railway Mechanical Engineer*.

Surely the writer of the editorial does not mean to intimate that a drawbar pull of 22,078 lb. represents the maximum capacity of the Pennsylvania 2-8-0 locomotives of Class H-6-A. If he will turn to page 141 of the book, "Locomotive Tests and Exhibits," issued by the Pennsylvania, the following significant statement will be found: "Higher drawbar pulls were not obtained because at slow speeds and long cut-offs there was constant danger of stalling the brakes and slipping the drivers, owing to the fluctuations of the pressure of the water used for controlling the brakes."

Since the testing plant has been moved to Altoona, these limitations have not applied and, therefore, the maximum drawbar pulls obtained at present are by no means comparable with those registered at St. Louis.

If it is desired to compare the most advanced locomotive practice of today with that of 21 years ago, solely on a basis of fuel economy and general efficiency, why ignore the performance recorded by the Michigan Central locomotive No. 585 on the St. Louis plant? This locomotive, despite its limitations in other respects and notwithstanding the fact that it possessed but few of the fuel-saving refinements which are now found so essential, need not fear comparison with today's best machines on an efficiency basis.

Michigan Central cross-compound 2-8-0 locomotive No. 585

	Maximum	Minimum
Dry coal per d. h.p. hr., lb.	3.61	2.14
Boiler efficiency, per cent	78.42	49.81
Machine efficiency, per cent	94.16	74.98
Locomotive efficiency, per cent	8.04	4.80

Wm. T. Hoecker.

The evaporative capacity of locomotives

Burnham, Pa.

To the editor:

In his rather elaborate study of the evaporation in locomotive boilers in the August and September issues of the *Railway Mechanical Engineer*, Mr. Poperev criticizes the accuracy of some methods I have used in analyzing tests of locomotive boilers. May I suggest that before this criticism is taken too seriously, careful consideration be given to the purposes for which my methods were developed and also to the rather antiquated foundation on which two out of three of Mr. Poperev's elaborate equations are built.

In studying the relation between steam produced and coal used, I have shown that within the range of experimental results available, the boiler efficiency if plotted against the rate of firing follows closely a straight line relation. In a recent account* of the use of this relation I wrote—

> This method of plotting boiler efficiency against rate of firing is of considerable value in the study of locomotive operation. In all tests of coal burning locomotives that the writer has examined the straight line relation between boiler efficiency and rate of firing is characteristic. It does not seem possible to connect this straight line relation to any fundamental laws, but experience shows that as an empiric rule it can be safely counted on.

Mr. Poperev states that there are "convincing reasons for doubting the correctness of the method accepted by Mr. Fry," but he shows nothing which contradicts the statement above. His only criticism is that for very low rates of evaporation the straight line relation will not hold. Theoretically the point is well taken, but it has little practical importance as the rates of evaporation at which the relation departs perceptibly from a straight line are lower than occur in any tests available and much lower than are met with in practice. Within the range of working covered by the tests, the complicated hyperbolic curve for boiler efficiency chosen by Mr. Poperev flattens out so much that for all practical purposes it is indistinguishable from a straight line. Since there is no advantage given by the more complicated curve at normal rates of evaporation, it is preferable to use the straight line on account of its simplicity and the ease of determining the constants corresponding to any given set of test results.

Apart from the increase in complication without a corresponding increase in practical accuracy, further criticism of the Poperev equations may be made on the score that too broad a generalization is attempted from too narrow a body of data.

It is shown that the relation between equivalent evaporation and the rate of firing can be closely approximated by an equation of the form—

$$Ze = a + bY + cY^2 \text{ ——— (1)}$$

Where Ze is the equivalent evaporation per sq. ft. of heating surface per hour, Y is the rate of firing in pounds

* A Study of the Locomotive Boiler, by Lawford H. Fry, page 46.

of dry coal per sq. ft. of grade per hour and where *a* is a constant and *b* and *c* are coefficients dependent on the boiler design and quality of fuel.

Three groups of equations are given by Mr. Poperev for determining the values of *b* and *c* from the boiler dimensions and the heating value of the coal. The number of boiler tests in each group is as follows:

1—For boilers using bituminous coal with firebrick arch, seven tests.
2—For boilers using semi-bituminous coal with firebrick arch, six tests.
3—For boilers using semi-bituminous coal without firebrick arch, six tests.

Now as far as the equations in groups 2 and 3 are concerned, it should be noted that the semi-bituminous coal used was of a type shown by the tests to be poorly adapted to locomotive use, and none of the boilers had superheaters or combustion chambers, so that the tests are not representative of modern practice. The boilers and coals of the tests in group 1 are representative of good current practice, and probably the coefficients given are applicable to the seven tests in this group, although very little direct evidence as to this is offered. It is highly questionable though whether the equations given for determining the coefficients are generally applicable to boilers of other designs. The only two variables taken into account in these equations are the heating value of the coal and the ratio of evaporative surface to grate area. Very little study of tests made on locomotive boilers is required to show that these two variables are entirely inadequate to characterize completely the operation of any given boiler. Boiler efficiency can only be studied properly if it is separated into its two components, i.e., efficiency of combustion and heat production, and efficiency of heat absorption. The efficiency of heat production will be affected not only by the ratio of heating surface to grate and by the heating value of the coal, but also by the amount of air admitted to the firebox, by the relative volume of the firebox, by the size in which the coal is fired, and by the method of firing, whether hand or stoker, and further by the efficiency with which the firing is done which is determined by the skill of the firemen and also in the case of a stoker by the type of stoker. The efficiency of heat absorption will depend on the firebox temperature, on the relation of firebox surface to flue surface and on the length and diameter of the flues.

It will be seen that the equations proposed by Mr. Poperev leave out of account a number of factors of major importance and can, therefore, hardly claim to be based on fundamentally correct principles.

LAWFORD H. FRY.

Another comment on evaporative capacity

CHICAGO, ILL.

TO THE EDITOR:

The only reliable literature on the subject of locomotive boiler evaporation is based on testing plant or standing tests, during which all factors entering into the test can be ascertained in weight or measurement by accurate apparatus and handling. So-called tests made on the road are of the roughest approximation of accuracy, due to the exigencies of service and the complication of the mixing in of the engine and the auxiliary appliances, steam requirements and performance. Locomotives, however, are not built for testing plant service but for road service, which may account for the numerous and varied tests made.

In Mr. Poperev's article on the evaporative capacity of locomotive boilers which was published in the August and September issues of the *Railway Mechanical Engineer,* the formulas all contain constants based on "given" boiler and fuel. Fuel variations are bad enough. I was at one time an officer of a railroad on which the finest steam coal mined in this country was handled in vast quantities, yet we had so-called "bad coal failures" as on other roads.

The dimensions and arrangement of the boilers under consideration are likewise under "given" limitations, set up largely by the personal factors of the designers. The very important ratio of grate area to heating surface, as shown in Table 1, page 549, of the September issue, on a considerable number of locomotives, originated mainly on one road, ranged almost two to one.

The expression, "total heating surface" does not mean much; does not convey with any accuracy the heat transfer value per sq. ft. A large percentage of the flue and tube heating surface is of relatively low value. With a given firebox, one boiler may have 15-ft flues and another, due to wheel arrangement requirements, may have 20-ft. flues; but the five additional feet are of no real evaporative value, although taken in the formulas as of average value.

It is possible to find an equated value to cover the evaporation of tubes and flues for any length, size and spacing from fairly well established tables as used in locomotive design. If such values are deduced in terms of firebox evaporation and added thereto, it will give an expression of the real amount of heating surface on equivalent basis of evaporation for the boiler as a whole.

I also want to take exception to the omission of superheating surface in such formulas. The locomotive is a heat engine and all heat developed on the grates and the total heat as measured when steam is released for duty should be credited in the performance and expressed in the boiler efficiency. In a recently published test, the heat transfer across superheating surface was approximately 11 per cent of the total transfer of heat output to steam.

What has been said is not with the idea of evolving a formula, but to advance some practical considerations in boiler performance to assist the mathematicians in clearing up some debatable features of the constants employed.

C. A. SELEY
Consulting Engineer, Locomotive Firebox Company.

Encouragement from a reader

EL PASO, TEXAS.

TO THE EDITOR:

For several years I have been a reader of the *Railway Mechanical Engineer* and now want to express my admiration of the persistence with which you have tried to impress on the railway public the necessity and importance of apprentice training. As an apprentice and since finishing my apprenticeship, I have been interested in the articles appearing in your magazine on the above subject. They have been of a constructive nature at all times. The articles written by the apprentices have been particularly interesting in that they show that worth-while boys are taking an interest in their training.

To my mind, the biggest factor in apprentice training is to use the best judgment possible in hiring the boys. Then do the utmost in making finished artisans of them. So many times haphazard methods are used in choosing boys that it is no wonder that a poor-class of mechanics is the result. The returns paid on such an investment, in a boy in training, cannot be estimated and, from a selfish viewpoint it is incumbent on the railroads to give more time and thought to hiring as well as to training apprentices. ASSISTANT ENGINEHOUSE FOREMAN.

The making of a railroad officer*

FOR a long time there has been an insistent demand for a book on leadership, particularly directed or applied to the needs of the railway field. As the responsibilities of railway officers and foremen have increased and extended and the duties have grown more and more exacting, these men have been on the look-out for information that would help them to take advantage of the best thought on how they might improve their leadership ability. There have been hundreds of books and thousands of articles published in recent years on the art of management and personnel administration. These are rather high sounding terms for the busy foreman or officer who is constantly being crowded for results, who often has far more men under his direction that he should have according to the best practices, and who in many cases on a railroad has the forces scattered over a large area. Unfortunately most of these books and many of the articles have lived up to these high sounding terms, and it has been extremely difficult for the average man to study them with any great degree of enthusiasm, or, indeed, to profit much from them. Then there is a great group of younger men in railroad organizations who have been trying to find some way of preparing themselves for promotion.

A successful railroad officer who early recognized this need and who possessed more than ordinary powers of observation and had had unusual success both as a leader and in developing the men under him was finally inspired to prepare a book particularly directed to the needs of railroad officers, foremen and ambitious workers. While Mr. Woodruff, the author, clearly outlines the principles of good organization and successful leadership, it is not done in the usual text-book fashion, or in the cold formal manner adopted by writers of technical books. Rather, Mr. Woodruff has thrown into the book much of his energetic, enthusiastic, constructive personality and we find the statement of principles backed up by, or even included in, interesting observations and personal experiences. This makes the book easy to read and study.

The book covers a wide range, as is clearly indicated by the chapter headings which follow, but on the other hand it is accompanied not only by a complete index, but the table of contents includes under each chapter heading a comprehensive synopsis by listing the subheadings. Moreover, to facilitate reference, the subheadings are printed in bold face type, so that they can readily be located. The chapter headings are: Why This Book; Service; Co-operation; Study of Human Nature, followed by five chapters relating to the study of profiles, heads and other distinctive types; Differences Between Men and Women; Expression or General Appearance; Employment; Psychology and Memory; Job Analysis; Planning the Work; Organizing the Work; Treatment of Men; Cost Studies; Charting Statistics; Elimination of Emergencies; Safety; Public Speaking; Further Application of Salesmanship Principles; Ethics of Railroading; Staff Teamwork; and Personal Application.

In commenting upon the book and its table of contents the Railway Age recently said:

"These are only a very few of the subjects covered, but they are perhaps sufficient to give an idea of the range of the work. And the author bases all his principles and generalizations on definite instances which have arisen in his experience. This keeps the subject from soaring above the head of the literal-minded reader and also serves to make his recommendations specific. There will doubtless be differences of opinion concerning some of his statements, but if one should write a book covering this field and include in it only those principles on which there is general agreement, the book would be so elementary as to lose its value outside the kindergarten. Too many books dealing with the technique of various occupations have stumbled into this fault, and it is encouraging to see this author avoid it even at the expense of arousing some criticism on the part of those who will not agree with all his conclusions.

"But this quality makes the work of value to railroad officers who have already 'arrived'—persons who could not possibly be interested in it otherwise. These readers will look at the work not so much as an authority telling them how to succeed—they have already done that—but rather as a collection of intelligent observations and comments by one of their own kind, with whom they may differ as they see fit.

"Readers of this calibre—and probably many of the younger men too—will, we believe, question the length to which the author goes in placing his trust in the so-called 'science of character analysis,' whereby it is believed possible to lay down definite rules concerning the characteristics of men according as they are blondes, brunettes, high-browed or lantern-jawed, and so on. The author is perfectly honest about it and says in a footnote that the possibility of so arriving at an approximation of character is questioned. But even if it is possible to arrive at accurate conclusions from the observations of features, the fact remains that it is a task for experts. It is probably true to say that, other things being equal, blondes are thus and so. But other things are *not* equal. A skilled character analyst knows this and is careful to weigh all the factors obtainable, but even then his estimates are not always free from error. It is doubtful whether the author can successfully inculcate sufficient knowledge of the subject in his brief treatment of it to make his readers expert therein. They must, therefore, look upon his statements merely as introductory to the subject and await further study and richer experience before they begin dogmatically to judge their fellows with these rules."

A book of this sort can not only be read and studied to excellent advantage and profit by the individual, but it can also be used with good results for group study or in connection with club or open forum discussions and will undoubtedly find a large field of usefulness in this way. Mr. Woodruff has placed the railway world under deep obligations to him by recognizing and filling in so acceptable a manner one of the greatest needs of the present day.

* The Making of a Railroad Officer, by R. E. Woodruff, superintendent of the Erie Railroad. 244 pages, 5 in. by 7¾ in., bound in cloth. Published by the Simmons-Boardman Publishing Company, 30 Church street, New York. Price $2.00.

DURING THE YEAR 1924 the Canadian railways paid salaries and wages amounting to $239,864,265, a decrease from the previous year of over $13,000,000. The number of freight cars in service was 226,163 with a total capacity of 8,283,264 tons, or an average capacity of over 36 tons. Passenger train cars totaled 6,849. There were 5,857 locomotives in service, including 29 electric. The total fuel consumed was 9,307,372 tons at a cost of $51,279,428. The consumption of ties totaled 14,294,416 at a cost of $13,216,325.34.

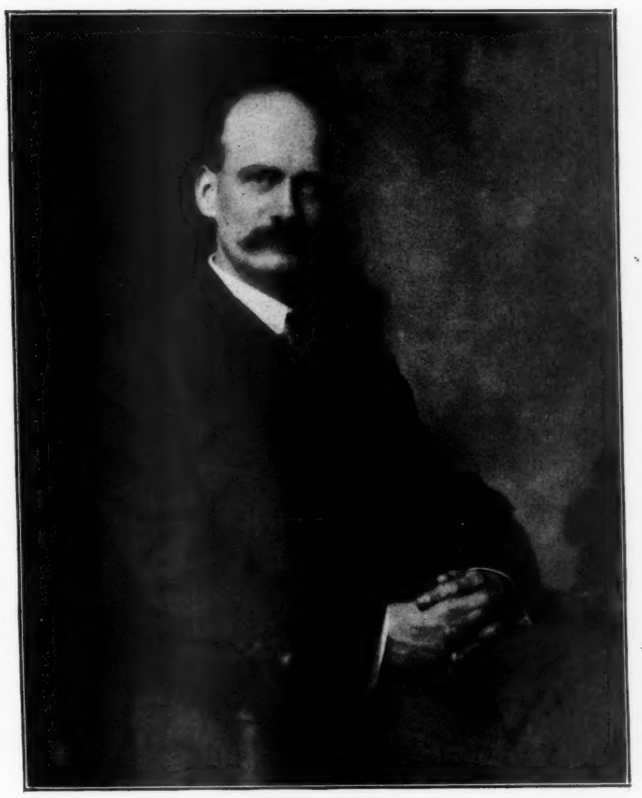
GOOD HEALTH PROFITABLE ALL AROUND.—Dr. M. R. Taylor (quoted at the National Safety Council convention at Cleveland) in discussing the stimulation of production, said: "The modern employer has come to realize that the human machine pays a far larger return on the investment in its upkeep than any piece of iron or steel ever can or will. Physical health is man's greatest asset; and as this is true individually, it must be true collectively; therefore, the capitalizing of it should become a consequential factor in all industries. A well-organized industrial medical department should be as beneficial to the employer as to the employee."

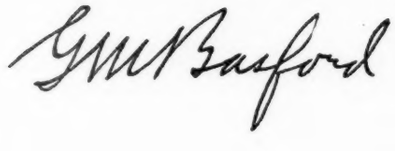
George M. Basford passes away

Former editor of this journal—Noted mechanical and signal engineer and technical publicist

GEORGE M. BASFORD dropped dead in the Jerome avenue subway station in New York City on Monday evening, October 26. Funeral services were held in Mount Vernon, N. Y., on Wednesday evening, and the interment will be at Boston on the return of Mrs. Basford from abroad.

During the early years of the present century this publication, then the American Engineer and Railroad Journal, was familiarly known among its readers as "Basford's paper." He was a fitting successor in its editorship to M. N. Forney, who had exerted so great an influence upon the upbuilding of American railroads. It is not surprising that the readers recognized it as "Basford's paper," because for a number of years he carried almost the entire burden of editing it, exerting a strong leadership in mechanical department affairs and gathering around him as counsellors the outstanding and most constructive men in the railway mechanical field. This significant statement was made when he laid down the editorship in the fall of 1905: "Mr. Basford has fought the battle of the motive power department, consistently and systematically maintaining that it should be properly and fittingly recognized because of its real importance in the organization of railroads."





The locomotive made a special appeal to Mr. Basford from his boyhood days, and without question he has had a larger influence upon the development of the modern steam locomotive than any other one man. Not that he ever patented or perfected any detail of locomotive design; but rather because of his keen engineering ability, and his vision and realization of the possibilities of the locomotive. He was constantly suggesting to the designers as individuals, or to the readers of this publication when he was an editor, what steps could best be taken to improve and develop it. He was, for instance, quick to recognize the possibilities of the application of the superheater, the Walschaert valve gear, the feedwater heater and many other special devices or new features of general design. He enthusiastically advocated such improvements in season and out of season and he encouraged designers and builders to experiment with them until they were finally perfected and came into general use. More than this, he recognized the importance of a larger utilization of the locomotive and did much to encourage the analysis and study of locomotive operation in order to determine just how this could best be accomplished.

For a few years before taking up editorial work he was a signal engineer and this experience and a study of the economics of signaling, led him to recognize in even a greater degree, the possibilities of a maximum utilization of the locomotives and track, resulting in more efficient and economical operation. Mr. Basford was always an enthusiastic advocate of railroad and technical associations because he recognized the inspiration and help that men receive from getting together and comparing notes and pooling experiences. "There is no reason," he used to say, "why an editor should not occupy a place of constructive leadership if he locates and keeps in touch with the leaders in specific fields. By getting around among these men, the editor, on the basis of their combined experiences, should keep ahead and be a great help to any one or all of them." It was a realization of the value of exchanging and combining experiences that caused him to get his fellows in the signal field to organize the Railway Signaling Club, later the Railway Signal Association, and now the Signal Section of the American Railway Association. He was familiarly known as the "father" of that organization and continued throughout his life to take an active interest in it, although in later years his work led him at times almost entirely into other fields of activity.

It hardly seems possible now that only a comparatively few years ago mechanical engineers felt that they were not concerned with questions of management and the human element; that their field was concerned more with materials and methods. Even in such an outstanding

organization as the American Society of Mechanical Engineers, it required a hard fight on the part of the more progressive members to have a consideration of these matters included in its program. Mr. Basford was among those who early recognized the importance of the human factor in industry and in the railroad service. He saw the railroads growing larger and more important, the cars and locomotives increasing in size and capacity and the problems of operation and maintenance growing more and more complicated, and was deeply concerned with the education and training of leaders who could maintain this progress and direct it along the right lines. He recognized the great waste of effort and energy caused by lack of adequate leadership and lack of training and education on the part of both the supervisors and the workers. The seriousness of this problem grew more and more on his mind and resulted in his paper on "The Technical Education of Railroad employees—The Men of the Future," which was presented at the American Railway Master Mechanics' Association in 1905. It was this paper more than anything else, that awakened the mechanical department officers to the necessity of giving greater attention to the selection and training of the workers. It was directly responsible for the inauguration of modern apprenticeship systems on the Santa Fe and the New York Central. It is doubtful if even Mr. Basford's most intimate friends understood the tremendous effort and the infinite pains that he took in preparing this treatise, submitting it before it was put into its final shape to many of the leaders in the railroad world at that time, including men like E. H. Harriman and James J. Hill. In commenting on this paper the Railway Age Gazette, now the Railway Age, said in its issue of March 14, 1913:

"The preparation of this paper might well be studied by young men who are ambitious to make their efforts felt in the railway field, and it affords a marked contrast to some of the papers and reports which are often presented before railway clubs and technical associations. It was the result of years of study of conditions on the railroads in this country and a practical experience in mechanical department work. Foreign methods had been carefully looked over on his trip abroad and then the whole scheme was carefully planned and outlined. The paper was then drafted roughly and was rewritten and rewritten until every sentence was carefully rounded out and every superfluous word removed, so that the thought was clear and forceful throughout. It was then submitted for criticism to a number of leading railway officers and industrial managers, and their comments were carefully considered in its revision, although it may truthfully be said that such revision as was made was very slight indeed. And dominating it all was a broad spirit of fellowship for his fellow man, which is so characteristic of Mr. Basford. It is little wonder that it marked the real cornerstone of railway apprenticeship education in this country, and it is to be regretted that more railroads have not adopted and lived up to its spirit."

Mr. Basford was constantly on the look-out for the opportunity of inspiring and helping promising young men, in order that they might better prepare themselves for making the best possible use of their talents. No sacrifice of time or energy was too great to make for those who called upon him for advice or assistance. The latch string of his office was always on the outside and there has been a constant stream of young men, and older men, too, going to him for advice and inspiration. He proved to be a haven in times of stress; indeed, at times when his personal problems were giving him the deepest concern and seemed to be about all that he could bear, he would be found temporarily laying them aside in order to help someone in distress. It is not surprising, therefore, that in 1903 a large number of his friends, realizing that he himself was greatly in need of relaxation and encouragement, united to send him abroad with his wife for a number of months. Even then he insisted on keeping in the harness and the valuable record of his impressions of foreign railway practice represented appreciation for the tribute that his friends paid to him.

It is difficult to recognize in a proper way the great influence which Mr. Basford had on raising the standards and value of the advertisements in the technical press. His long engineering and editorial service, his broad training and large vision, supplemented by experience in salesmanship, brought a new force to bear when he entered the advertising field. It is a far cry from the day when advertisers changed their copy only once or twice a year and ran little more than a card, to these days when advertising copy is changed in every issue and advertisers go to great expense to secure that kind of copy which not only possesses a strong educational value, but specifically aims to give the possible user of the device or material accurate information about the functioning of the device and how it may best be utilized, with concrete information as to its advantages. Mr. Basford's ideal was to rival the editor in making the advertising pages so instructive and interesting that the reader would turn to them first on opening his paper. That he and others who caught this same vision have achieved a large degree of success, is widely recognized.

Mr. Basford was constantly being approached for advice by officers and subjects committees of the different railroad associations and clubs, and not a few programs of the most successful conventions and club meetings have been due to the help that he gave, remaining, however, usually in the background. The records of these organizations over a period of years contain a considerable number of his addresses, every one of which was prepared with the greatest care, being presented only after he had painstakingly revised and reviewed them a number of times.

Mr. Basford was born in Boston in 1865, where he attended the public schools. He was graduated from the Massachusetts Institute of Technology in 1889, after which he entered the Charlestown shops of the Boston & Maine, later going to the Chicago, Burlington & Quincy as a draftsman at Aurora, Ill. He left the Burlington to take a position in the motive power department of the Union Pacific, and was connected with the test department of that road for some time, after which he entered the service of the Chicago, Milwaukee & St. Paul as signal engineer. Later he was superintendent of construction of the Johnson Railroad Signal Company, was with the Union Switch & Signal Company for a short time, and then became signal engineer of the Hall Signal Company. In 1895 he became mechanical department editor of the Railway and Engineering Review, and in 1897 was made editor of the American Engineer and Railroad Journal, now the *Railway Mechanical Engineer*. In September, 1905, he was made assistant to the president of the American Locomotive Company. It was during this period that for a number of months he was called upon to give part of his time in helping to start the Railway Business Association, rendering exceedingly effectual and much appreciated service. In March, 1913, he became chief engineer of the railroad department of Joseph T. Ryerson & Son. Mr. Basford organized the G. M. Basford Company to handle technical advertising in March, 1916. At about this time he was also made president of the newly organized Locomotive Feedwater Heater Company and headed it for several years until it was taken over by the Superheater Company. He was also consulting engineer of the Lima Locomotive Works, Inc.

"Bill Brown" and "Top Sergeant"

"Bill Brown's" policies and the editors of this publication are both severely criticized

THE *Railway Mechanical Engineer* had no idea when it announced the competition on the responsibilities and opportunities of the foreman that it was going to start a lively controversy, the participants in which would not be too busy in their efforts to belabor each other to toss a few brick-bats at the editor.

A few days before going to press we received a letter from the head of one of the mechanical departments as follows:

"There is a Scotch couplet that goes something like this:

'O wad some power the giftie gie us,
To see oursel's as other's see us!'

"With this thought in mind, I am attaching a copy of a letter sent me by one of our inspectors. It is interesting in more senses than one, but as it furnishes food for thought to the editor of the paper presenting the prizes, it has occurred to me it would be of special interest to you."

The article which accompanied the letter gives "Bill Brown" as well as the editors something to think about. We can see "Bill" grin as he reads the following extracts from this letter—or possibly he may be getting worried over some of the things that are being said about him.

Ridicules "Bill Brown's" article

"In the first place, were the article of intrinsic worth, surely a *nom de plume* would not be considered necessary. That in itself proclaims its greatest weakness and creates a doubt in my mind as to the genuineness of "Bill Brown."

"The new foreman.—Today in most shops time is figured out down to the fraction of a cent and the opportunity for calling all the men away from their respective machines for no other reason than to say, 'I have been made foreman' and to offer excuses—as one might reasonably interpret 'Bill's' remarks—is hardly to be expected. When a man is made foreman, be he stranger or otherwise, his actions from the start should be his introduction to the men. Let him realize that he is but one step ahead of the journeyman under him. It does not always follow that to be a successful foreman one must be the best mechanic; other qualifications just as important are very necessary and possibly it was for these he was chosen. The journeyman's ideas are often best and should be considered. I will agree with 'Bill' that the day of the hard-boiled driver is past. He was an abomination and his real efficiency was usually a minus quantity. The educational standards of our country today are such that the average mechanic is usually found to have a high grade of intelligence and as such should be respected. 'Bill Brown' by his patronizing tone would seem to ignore this point.

"Keep posted about railway affairs.—In his article 'Bill' surely allows his fancy to take a wonderful flight. He says, 'Give half an hour each night to the columns of *Railway Mechanical Engineer* and the Railway Age and he will become fairly well posted on such all-important subjects as operating ratios, fuel saving, taxation, rates, etc.' The idea of a machine shop foreman becoming fluent enough to discuss in an educational way the above topics and staying a mere foreman when such a knowledge of any one of them would offer its possessor a salaried position far in excess of 'Bill's,' is hardly understandable. I doubt very much if one could assimilate all this knowledge from periodicals. I feel that to devote a half hour each evening to furthering one's knowledge of his own particular brand of the work would be productive of greater results, not only to the employee, but also to the employer. Periodicals make light reading, interesting too, but as a usual thing eventually forgotten. As for the advertising columns, the maker and vender of each article claims its superiority over all others and to obtain an education through these channels would be out of the question. That was a rare flight of 'Bill's.'

"Treatment of new employees.—The new man is, as a general rule, anxious to make good, and I agree that his ultimate success lies in no small measure with his immediate foreman. The cost of labor turnover in some of our large shops is excessive and can only be written off by the employers as a total and, in the majority of cases, unnecessary loss. A proper study of human nature and the ability to strengthen the weak points of the new man, and place him where he is best fitted, would do much to lessen this item of expenditure and enhance not only the foreman's value, but also that of his men, in the eyes of the employer.

"'Bill Brown' mentions the fraternal pin. I disagree with his views on this. Experience has shown the writer that it is best to keep fraternal 'pull' out of a business such as 'Brown's.' Fraternalism and all it applies is one of the finest principles of our everyday life, in its proper place, and that to my mind is after working hours. To countenance any one 'pin' in the shop is to drive a wedge in your armor by the opposition, which is always to be found, and a consequent reduction in the general efficiency of a shop is the result.

"New tools or machinery.—When 'Bill' wrote this article his fancy was in the clouds, only to come to earth long enough to boost the *Railway Mechanical Engineer* and its advertising columns. He stepped blithely into the shoes of the master mechanic or superintendent and declared it most inexcusable for any foreman not to do so. A nice dream, but certainly neither practical nor educational.

"The sales engineer.—I will agree with 'Bill' that very often one can learn pointers from the sales engineers. More often than not they are practical men who have had shop training. One point, however, I cannot let go. He states that he has often been obliged (gladly) to work extra hours because of having spent some of his time during the day investigating their claims of devices. This statement sounds weak. In the first place, as a foreman, he was neglecting his duties during the working hours. Second, it is my belief that the average sales engineer is physically unable to carry around working samples of his wares.

"Attitude toward apprentices.—In part I agree with 'Bill' here. He is inclined perhaps to be too big-hearted, but a study of the human element would have to be the foreman's guide. No set practice can be employed.

"In summing up the entire article, I feel that 'Bill Brown' has hardly propounded any really practical views as to the duties of a foreman, but rather he has skimmed airily over these responsibilities with what is merely a

treatise on etiquette as he thinks it should be practiced in a machine shop, without giving thought to some of its impossibilities. The field of foremanship, especially with railroads, is too broad to be narrowed down within 'Bill Brown's' evident limits and it is hard to understand why a periodical of the status of the *Railway Mechanical Engineer* should laud and broadcast his views as being an outstanding example. Its paucity of detail, its impracticability, serves but to create an attitude of condemnation and doubt as to the article's veracity."

A more constructive letter—from a reformed member of the so-called hard-boiled group, at least so he characterizes himself—follows. Incidentally it tells why some supervisors are of the hard-boiled type.

Why some foremen are hard-boiled

Chicago, Ill.

To the editor:

It is gratifying to a lot of us old time foremen to see the interest being taken in trying to provide better opportunities for us, and to bring to us a greater realization of the importance of our positions.

I believe the generous response to your request for a free expression of opinion regarding the controversy now being waged relative to the divergent viewpoints of "Bill Brown" and "Top Sergeant" have opened the eyes of many to the fact that a great many foremen are and have been devoting much thought to this subject.

Personally I have been a most interested reader of all the articles which have appeared and while agreeing in the main with the stand taken by "Bill Brown," I can't help having a sort of sympathy with the "Top." Having started as a foreman thirty years ago, about the same time as he did, and presumably under similar environments, I can well appreciate why he is so hard-boiled. Years ago, especially in the part of the country where I was made, it was the rule to be hard-boiled. I was about as hard-boiled as they make them, and continued that way many years until I woke up to the fact that more and better work can be gotten out of men by leading instead of driving them. "Top Sergeant" don't seem to have learned that lesson yet. Maybe the "old dog don't want to learn new tricks."

In this day of enlightenment if a man in a supervisory capacity is hard-boiled, there must be a reason for it.

I started out, as I have no doubt "Top Sergeant" did—and as most foremen do when they are first promoted—with a very exalted idea of the things I was going to accomplish. I was going to show the "Big Boss" that never before in the history of railroading had a job been handled as efficiently as I would handle mine. I was going to be absolutely fair to all the men and give each one a square deal. I was going to so organize my work that none of it should lag behind on account of any lack of foresight on my part in ordering material or routing the various operations. I was going to be a real "humdinger." But I soon had many of my exalted ideas taken out of me.

My first job as a foreman was in a round house where I was compelled to handle about three times as many engines as we had stall room or facilities for handling. I had over double the number of mechanics, with their helpers and laborers, that any one foreman could handle efficiently. In addition to this there was no up-to-date machinery and very poor store room service. But regardless of these handicaps, I was optimistic and felt that I could deliver the goods.

After spending many hours at home when I should have been sleeping I matured a plan that looked mighty good to me. It called for a slight rearrangement of working force—adding a few mechanics and cutting off some laborers. I wanted a different arrangement of the tracks in the "garden" so that I could better handle the reserve power. I wanted a couple of new machines and a better supply of stock so that I could make and put into use some home-made tools that I felt would expedite the work. So many years have elapsed that I don't remember all the details of my plan, but I have a distinct recollection that if allowed to put my ideas into effect, I felt that our costs could be cut very materially.

Why I became hard-boiled

Full of hope and optimism, I put my ideas up to the "M.M." He was one of the old school of railroad officials who had forced his way up the ladder more by virtue of an aggressive personality, than by any real mechanical knowledge, but I had full faith in my ability to make him see the value of my suggestions. He read my carefully prepared plan over to the end. Then cocking his cigar at a more aggressive angle in the corner of his mouth, and glaring over the top of his glasses at me, proceeded as follows:

"What the h—— do you think I am, a fool? After handling the work at this point for ten years under the present line up, do you think I am going to confess to the management that we need to spend all this money for new equipment?"

"But, Mr. Jones, I thought—"

"To h—— with you, and your thoughts. I am hired to do the thinking around here. What's the matter with you? Can't you handle the job? If you can't, I'll damned soon put some one there who can. Get the h—— out of here now and get back into the round house and see that those men keep busy. If I catch any of them loafing on the job, I'll send you 'down the track talking to yourself'."

I needed that job. I realized that if I got fired my clearance would show lack of ability which would make it hard for me to get another chance. I went back into the round house determined to show the master mechanic, that if he wanted the job run the way it had been running, by hard-boiled, driving tactics, I was the man who could do it.

I must have succeeded after a fashion, for I was not fired. On the contrary, I gained the reputation of a hard, driving taskmaster, who would stand for no fooling. Later I was promoted to a somewhat more responsible position, so I was forced to the conclusion that my methods, if not of the best, were at least in accord with the popular ideas at that time.

I have never succeeded in building myself up to a real position in the railroad world, and as the years have passed I have more and more come to the conclusion that my methods have not been of the best. Regardless of the fact that I was driven by force of circumstances into a hard-boiled attitude of mind, I have always had a subconscious feeling that better work and more work can be gotten out of men by leading them than by driving. I have therefore welcomed the newer and better methods and have adapted myself to the present disposition on the part of the officials to exemplify the square deal in all relations with their employees.

I have gone into my personal affairs at length with but one object in view, and that is to point out the fact that if a foreman is hard-boiled, there may be an underlying reason for his mental attitude.

We will not be able to remedy conditions by painting beautiful word pictures typifying some super-foreman who possesses all the virtues and none of the faults of the rest of us poor mortals. If any of our foremen are hard-boiled, would it not pay to find out what their real or fancied reasons are for having that kind of a mental slant?

Inspiration must come from above

Why should it be necessary to preach the value of co-operative effort, education and the square deal to the foremen? Inspiration must necessarily come from above. Is it any less reasonable to think that the foremen would respond less quickly to such suggestions coming from their superiors, as they now expect the men to react to the teaching of the foremen?

Does not the very fact of the seeming necessity for such pronouncements to the foremen at this time constitute a serious indictment on the policies of their superiors in the past, and to some extent in the present? The foremen can go just as far and no farther than the stated policy of their company will allow. Like master, like man.

There are few foremen today who have not a full realization of all the advantages to be gained by following the policies set forth in the article by "Bill Brown." They don't need to be told those things. What they want is an opportunity to put them into effect.

They realize more fully, perhaps, than is generally suspected, that the first and greatest essential to success is a steady inflow of new knowledge that will better equip them in coping with their jobs. Very few of them get a chance to attend the conventions, and still less get an opportunity to travel around to observe the new methods in other shops, but all of them have an opportunity to subscribe to the technical magazines, and most of them do, Mr. Editor, or have done so at different times, until they have been satisfied that their efforts were futile. Personally I have received a great deal of good from reading the technical journals, but have seldom been allowed to put into use the many good ideas I have so acquired, on account of bumping into the "bogie" called "company standards."

What do they mean by company standards? Are they intended to be as unchangeable as the laws of the Medes and the Persians? Or should they be sufficiently elastic to permit of changing, if the occasion justifies? Should the foreman be instructed that these standards are inviolable, or should they be encouraged to figure out newer and better methods, with the understanding that they will be given credit if the changes are found acceptable?

Educational work must be directed

What effort is being made by the management of the different railroads to allow the foremen to present their side of the case? Are they encouraged to present their ideas in staff meetings or in articles? Is any effort being made to supervise and co-ordinate their reading to any practical end? Listen, Mr. Editor, let me give you an illustration of my meaning.

The field representative of your own paper, the *Railway Mechanical Engineer,* recently visited the shop where I work. He secured a subscription from every man of supervisory rank in the shop, as well as from a number of leading mechanics. He also sold a number of technical books. Before he left every man was provided with his text-books and had signified his willingness to study in order to be better equipped for his work. What was the result? No one to direct, supervise or co-ordinate their studies. No one to encourage them in applying the knowledge they may have secured, and no one of sufficient authority to permit of any changes of practice that might have been possible as the result of any knowledge so acquired. I don't believe your field man will have such good success here next year.

The railroads spend a lot of money each year in their safety campaigns. Good! It saves lots of lives and mutilated people as well as money for damage suits. They save lots of money by conserving coal, as the result of their fuel meetings. Why not spend a little money on an educational department that will direct and encourage the study that the foremen have signified their willingness to do, by virtue of having bought the necessary books?

Why not stop preaching at the foremen and co-operate with them in doing the things that they know, as well as you, are necessary to be done in order to ensure success?

JOE BUSH.

The foreman and his responsibility*

Emphasizes necessity for studying human nature and placing men where they can function to best advantage

By Zed E. Day

Gang foreman, C. C. C. & St. L., Beech Grove, Ind.

THE foreman has often been referred to as the "keystone in the arch of industry," and truthfully so, for as the keystone supports the arch of stone or brick, so does the foreman support and advance industry. His influence in this strategic point is felt by every individual connected with his organization, from the lowliest sweeper to the highest director. Since the foreman is such a vital part of the organization, it is well that he should take an inventory of his position and of himself and to come on speaking terms with his responsibilities and opportunities. The foreman is the one point of contact between the management and the worker; he acts as a representative for each. The manner in which he interprets the wishes of the management to his men forms the basis on which the men judge the management. Likewise the management will usually judge the workers by the way in which their problems and grievances are presented to them by the foreman.

It is within the foreman's power to make or break any rule, method, or process that it is desired to install, by the way in which he presents it to his organization. To the degree that he is for or against a proposition will it succeed or fail.

He is the one who organizes the workers—placing the right man on the right job; studying their characteristics; observing their strong points and their weak ones; helping them to overcome their weaknesses and to become of more value to the company. He is the one who knows and sympathizes with their problems, and instructs them in the

* One of the articles contributed to the competition on this subject.

most efficient manner of doing things. He is the one who arouses their interests to do greater and better things.

The foreman's principal job

His principal job is not, as a good many think, a matter of materials and machinery, but rather human nature. His chief responsibility is to study and know human nature, not only of his men, but also his own personality, so he will be enabled at all times to have proper control over the most essential element in industry—the human element—and at the same time have control of himself. Handling human nature is a battle and only fighters can win out in it.

Andrew Carnegie is reported to have said: "If I had to choose between losing my plants and equipment, or my organization, I would choose the former." Plants could be rebuilt and equipment furnished in a short time, but it would be the work of years to build another organization.

Since one of a foreman's main responsibilities is to organize his department, he should have a thorough understanding of the principles of organization. He must see that each man has certain duties for which he is held responsible, and that the man understands his duties and can carry them with a minimum of supervision. He must organize so that each little detail of his work is given to someone to perform regularly. He must learn to master detail—then learn to get rid of it. Too many responsibilities will break a man. The more details that can be taken care of successfully by others in an organization, the more time a foreman will have to do constructive work in improving methods and design. His advance in industry depends largely upon his organizing ability. This phase of his duties also presents a golden opportunity for mental development; he can experiment with men, the most intricate machine, by changing their duties occasionally, shifting them from one line of responsibility to another to ascertain their likes and dislikes, and to fit them in the right place. In doing this and observing his men he has the chance to learn the best way to organize, and will soon have a nearly perfect organization under his control. Great railroads, factories, steamships, telephone systems, and many other instances might be cited which are living monuments to organized forces intelligently directed.

Starting a new man

While the desire to produce more efficiently, and to eliminate waste is a paramount issue, it should not overshadow the need of training and the welfare of the worker. New men should be tactfully and judiciously dealt with, as their first impressions of a plant are likely to be lasting ones. Have a constructive talk with a new man to find out his aims and ideals, and inform him of the aims and purposes of the company, the quality of work expected; the location of the various departments; the natural progress of the product, and a general fund of good knowledge to give him his bearings on the job; an explanation of his assigned duties and their relation to the finished product. Finally invite him to feel free to ask any questions on anything he does not understand pertaining to his new work, and to make any suggestions for improvements in the plant that may occur to him. This policy will greatly reduce a tremendous waste due to labor turnover—a great problem in industry today.

The quality of the finished product is a responsibility which rests almost entirely with the foreman. He should familiarize himself with the quality of work expected and then produce nothing but work of that standard.

To the foreman who has vision enough to grasp these principles and apply them, I say his opportunities are unlimited. They will result not only in his advancement in industry, but also will he receive a great moral satisfaction which can result only in happiness and contentment in his work and in his life. This too, will make him worthy of his title, "The Keystone in the Arch of Industry."

Canadian National builds nine motor rail cars

Includes seven 60-ft. and two of articulated construction—Equipped with Diesel engines of light weight per horsepower

A NEW development in motor rail car design has been introduced by the Canadian National in the construction of nine Diesel-electric cars that are now being built at its Point St. Charles shops, Montreal, Que. Seven of the nine units are single cars having an overall length of 60 ft. and the remaining two are of the articulated type with an overall length of 102 ft. Including the articulated construction of two of the cars, the principal features in the design are the four-cycle Diesel engines and the use of three-passenger seats to obtain maximum seating capacity.

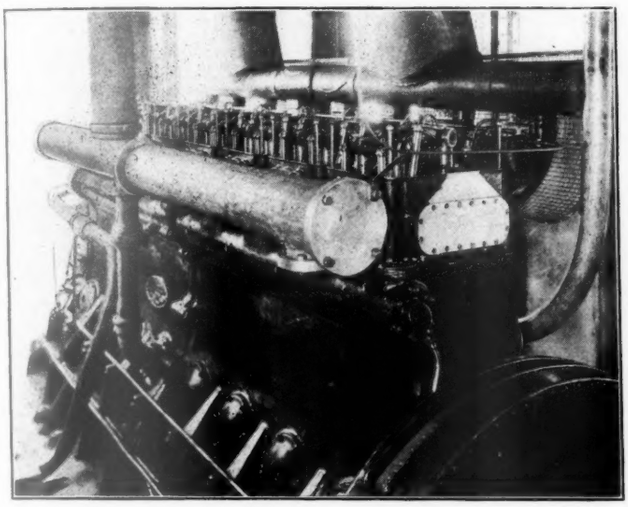
The engines

The engines installed in these cars were manufactured by William Beardmore & Co., Ltd., London, England. The design is a modification of this company's standard aeroplane engine which was changed to meet the service conditions of rail car operation. These engines conform to a modified Diesel cycle of the solid injection four-stroke cycle type and are arranged with four cylinders in line for the small unit which is used on the 60-ft. car, and eight in line for the large unit which is used on the articulated car. The cylinders in both engines have 8¼ in. bore by 12 in. stroke and develop 185 b. hp. at 700 r.p.m. in the small unit and 340 b. hp. at 650 r.p.m. in the large unit. The engine in the 60-ft. car weighs 2,750 lb. and that in the articulated car weighs 5,450 lb., or a fraction under 15 lb. per horsepower for the smaller engine and slightly more than 16 lb. per horsepower for the larger engine.

The low weight per horsepower was obtained through the selection of materials. The designers were able to reduce the thickness of the materials to a minimum through the use of high tensile steels and special alloys. For example, the crank case is of cast steel; the cylinder liners are made of forged steel; the cylinder heads, of

cast aluminum; the valve seats, of alloy steel; the pistons, of forged aluminum; the crank shaft of special forged alloy steel; the sump cover, of sheet steel; and the connecting rods, of special forged steel.

A feature in the design of these engines is the steel monobloc crank case, the upper part of which is bored out to receive steel liners, and thus form the water jacket around the liners. The main crank case casting carries the crank shaft bearings and also the base supports for



The Diesel engine installed in the articulated car—It is of light construction, weighing slightly more than 16 lb. per horsepower

bolting the engine to the underframe of the car. Large inspection doors are provided which give access to both end bearings. The lower part of the crank case consists of a light tray with an oil sump which is secured to the underside of the main casting. The main bearings are equipped with phosphor-bronze bearings lined with babbitt metal and are lubricated by a continuous oil pressure system. The connecting rods are made from special steel forgings, the top end bearing of which has a solid phosphor-bronze bushing, while the end is fitted with a pair of phosphor-bronze bushings lined with babbitt metal and fitted with an adjustable liner. Both bearings of the connecting rod are arranged for pressure lubrication.

The pistons are made from forgings of a special aluminum alloy and are machined all over and balanced before finishing. Each piston carries four cast iron piston rings in addition to a scraper ring. The steel liners which are pressed into the main crank casing are also of light construction. The cylinder heads are made of an aluminum alloy and are provided with large spaces for the circulation of cooling water. Each cylinder head carries two exhausts, two valves and a central automatic spray valve as well as a compression release valve. The exhaust from each cylinder enters a manifold on the side of the engine for which one exhaust pipe for every four cylinders is carried vertically up through the roof.

The main crank case is a light steel casting and carries the housings for the ball bearings on which the gear wheel spindles run. Attached to the main gear case are the duplex lubricating oil filters, the oil pump and the centrifugal type cooling water pump, which is also equipped with filters.

Separate fuel pumps which deliver the fuel to the atomizers at from 8,000 lb. to 10,000 lb. per sq. in., are employed for each cylinder. A primary pump maintains an oil pressure on the suction side of the main fuel pumps. The injection is timed and the engine output is controlled by varying the effective piston delivery stroke. Any excess oil is delivered back to the fuel tank through a by-pass gear. A light residue oil of .86 specific gravity is used for fuel.

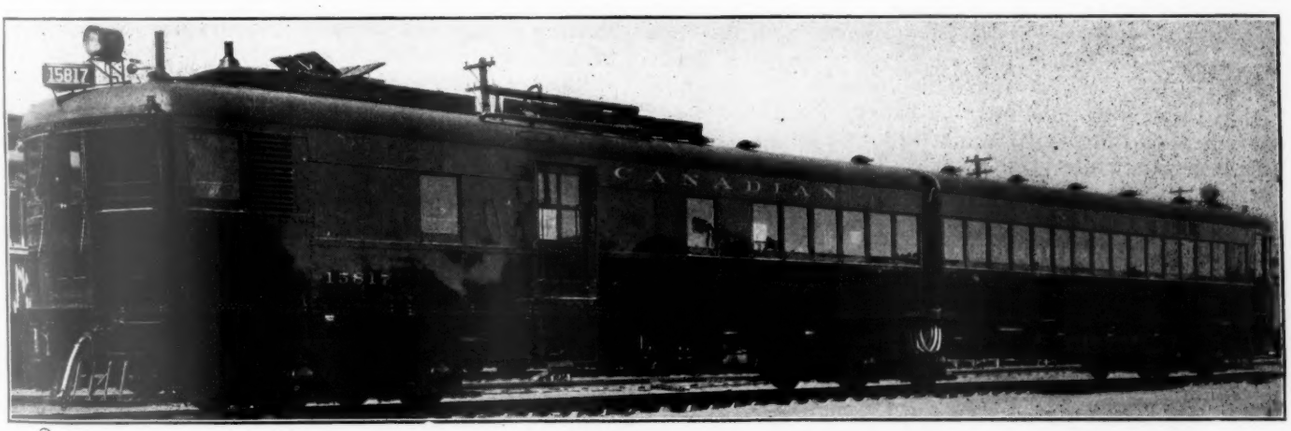
Engine auxiliaries

A centrifugal type governor driven off the crank shaft is coupled to the fuel pump control and is so arranged as to increase or decrease the oil supply to the fuel distributing system. It is fitted with an emergency device to cut the fuel pumps out of action should the r.p.m. of the engine for any reason be increased above the desired speed.

A centrifugal pump is used to circulate cooling water through the engine. This pump is mounted on the main gear case and can be easily detached for examination. Flow indicators are installed in the lubricating oil and cooling water circuits which indicate a stoppage of flow by lighting a lamp in the operator's room.

The tanks for water, fuel oil and lubricating oil are all made of 3/16-in. and ¼-in. aluminum plate and are located in the engine room. The piping is of aluminum, except in a few places where copper is used. The water tank on the 60-ft. car has a capacity of 120 gal.; the fuel oil tank, 75 gal., and the lubricating oil tank, 50 gal. On the articulated car the water tank has a capacity of 240 gal.; the fuel oil tank, 150 gal., and the lubricating oil tank, 100 gal.

Midwest air filters are applied to all of the cars for



Canadian National articulated Diesel-electric motor rail car

filtering the air supply to the engines. The filters used on the 60-ft. car are mounted on the ceiling of the engine room, while those on the articulated car are mounted on the left-hand wall of the engine room which is provided with shutter inlet to keep out the rain or snow.

The 60-ft. car has two full-size Rome Turney radiators mounted on the roof for cooling water and one half-size for cooling lubricating oil. The articulated car has four full-size radiators for cooling water and one full-size radiator for cooling lubricating oil.

The lubricating oil is forced under pressure to all working parts, including those of the cam shaft. Oil is drawn from the well in the sump, located at the gear case end of the engine, and is then forced through double filters via the cooler on the roof to the main supply tank. These filters can be cut out and cleaned while the engine is running. The oil then flows by gravity from the tank through a second pair of filters to the compressor pump which forces it through the crank shaft to the journals and pins and thence to the small ends at about 60 lb. pressure. A connection also leads to the cam shaft and oil is forced up through the center of the cam shaft to the bearings. Provision has been made to drain the unused oil in the engine back to the sump well.

The electrical equipment

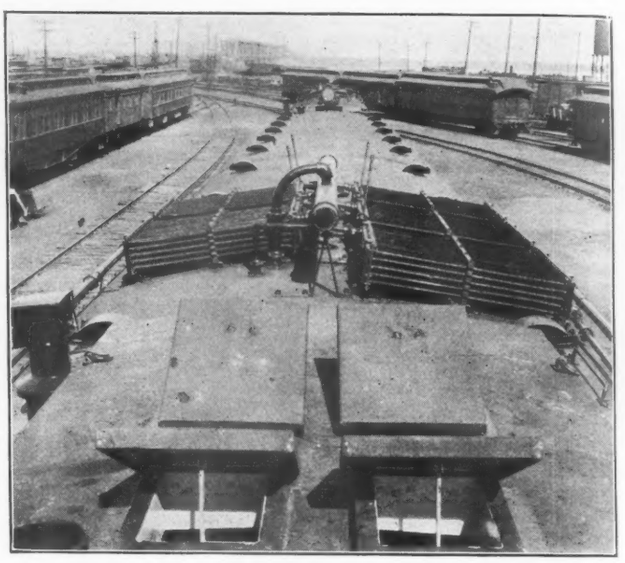
The electrical equipment on the articulated car was manufactured by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., and consists of a 200-kw., 600-volt d.c. generator mounted on a common bed plate with the engine and connected to it by a Fast flexible coupling. Pressed felt liners 1½ in. thick are placed between the bed plate and the car sills to absorb vibration.

The generator is differentially compound wound, the shunt field being excited from a 300-volt battery. The motors are 600-volt railway type 548-C-8, with a one-hour rating of 145 amp. connected permanently in parallel and mounted two on each of the front and rear trucks and connected to the axles by helical gearing.

The car is operated by master controllers located at each end, different speeds being obtained by a resistance control of the main generator field. Besides the master controllers, the main control apparatus consists of a switch group comprising eight electro-pneumatic switches, two reversers, an overload trip relay, and a sequence drum. The auxiliary control apparatus consists of a potential relay, an ampere hour meter, a battery charging relay, a field relay, a throttle valve, a control and reset switch and the necessary knife blade switches for the control of the several circuits. False operation of the various circuits is prevented by necessary interlocking between controls, which also makes the operation practically automatic.

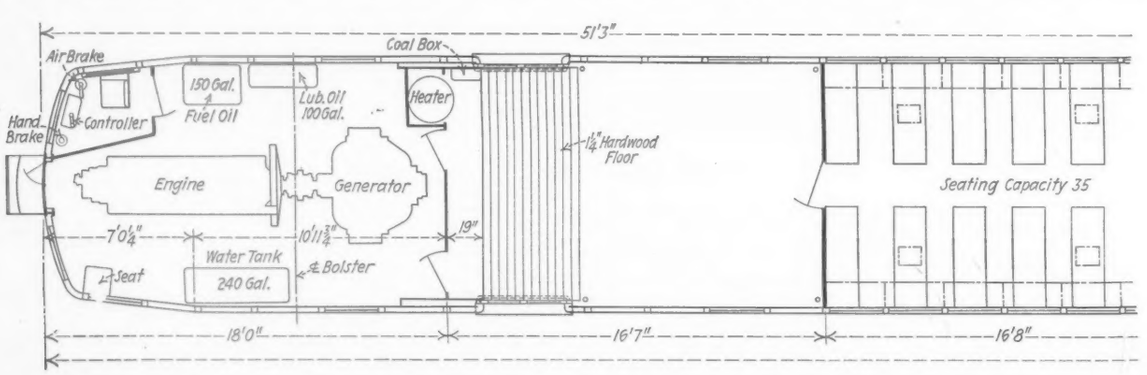
The air for the magnet valves is taken from the air brake system and is maintained at about 70 lb. pressure, the electro-pneumatic control being the standard H.L. equipment throughout. The acceleration of the car is practically automatic as the control can be thrown to the "full" position, allowing the sequence drum to increase the generator voltage in four or five seconds. All controller positions are, of course, running positions, and lower speeds than the maximum can be obtained by intermediate points on the controller.

The engine is started by the generator driven as a motor, from the 300-volt battery, this starting position being obtained from the controller by moving the operating handle contrary to its operating direction. The engine starting position is also the battery charging position when the car is standing. By motoring the generator the 300-volt battery brings the engine to a speed of about 200 r.p.m. at which speed it fires on the first compression, the starting current for about two seconds being a maximum of 480 amp. down to 230 amp. at 150 volts. The battery voltage is applied to the generator through resistance steps and at the same time the engine throttle is moved by an electrically controlled air cylinder to full fuel position.



Top view of the articulated cars showing the radiators for cooling the oil and water

The battery is composed of 150 cells, M.V.A. 17 Exide Ironclad, and is located in two sections in steel boxes suspended from the floor of the rear half of the car. With the car running and the controller on either of the last



Floor plan of the articulated motor rail cars

two notches, the potential relay cuts in and allows the generator current to charge the battery. This continues as long as the controller is on either of the last two notches or until the charging current is cut off by the ampere-hour meter.

Besides being used for starting purposes, the battery also supplies the control circuits at 30 volts; the generator field excitation at 300 volts; the two air compressors at 300 volts, and the car lighting at 30 volts. Low voltage circuits can be distributed over 90 of the 150 cells and standard lamp regulators are used to compensate for the charging voltage. Emergency switching is provided so that any of the 30-volt sections can be charged from the generator while the car is standing. One of the main reasons for having the 300-volt battery is that in case of necessity, owing to a total engine failure, the car can be moved on half voltage to the next siding, in order to clear the main line.

In carrying the circuits across the articulation, every effort has been made to secure accessibility and reliability. All the control wires are carried through the ceilings of the cars, terminating at each side of the articulation in junction boxes located in the car ceiling. The only heavy cables crossing the articulation are the generator bus liners to the motors, the battery line to the generator and the train line lighting circuit. By locating a reverser on each half of the car, the necessity of carrying the motor leads across the articulation is avoided. Multiple unit control has been installed so that two or more cars can be operated from any one operator's position.

The electrical equipment of the 60-ft. car was manufactured by the British Thomson-Houston Company, Rugby, England and the General Electric Company, Schenectady, N. Y. The generator, which was shipped with the engine from England, is a 105-kw., 600-volt d.c. differentially compound wound machine mounted on a common bed plate with and rigidly connected to the engine. Pressed felt liners 1½-in. thick are placed between the car sills to absorb vibration. On the same shaft with the generator is mounted a 6-kw. 60-volt exciter. The balance of the electrical equipment consists of two G.E. 240-A, 600-volt, 150-amp. (one hour rating) railway motors, mounted on the front truck and connected through helical gears. The controllers located at each end connect the motors in series, parallel or shunt field forward, and series or parallel reverse.

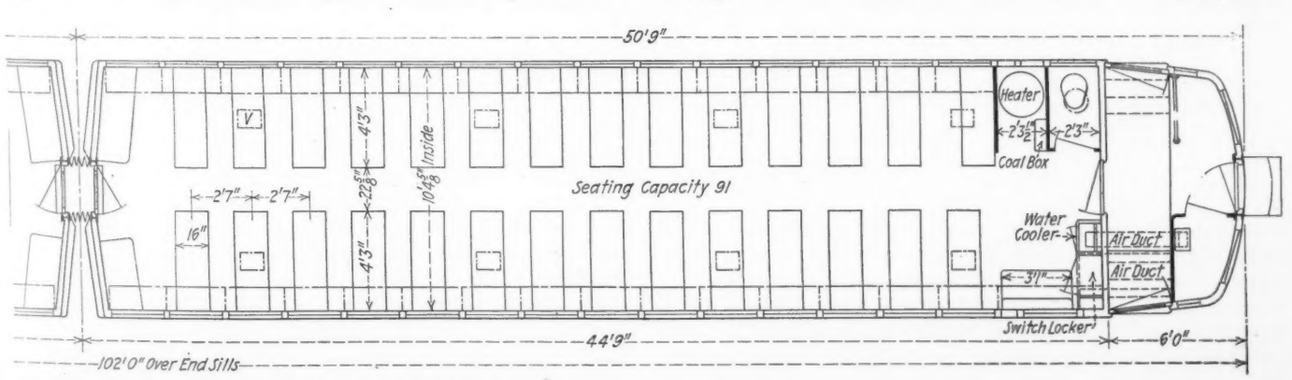
A 120-volt M.V.A. 17 Ironclad Exide battery is carried underneath the rear of the car. Thirty cells are suspended from the floor in a steel battery box on each side of the car. This battery furnishes starting current for driving the generator as a motor in a manner similar to that described for the articulated car, only 16 cells of which, however, supply the excitation of the exciter field and the car lighting. The 120-volt battery is charged from the generator by a special charging circuit used while the car is standing. The 32-volt portion is automatically charged by the exciter when its voltage is higher than the battery voltage.

One of the seven 60-ft. Diesel-electric motor rail cars being built by the Canadian National

The car speed is controlled by the engine throttle, which is mechanically connected to an operating lever located in the operator's cab at each end of the car. The electrical controllers merely connect the motors to the generator circuit in series or parallel and are not used to operate the car. The first movement of the throttle lever closes the throttle relay switch, thus closing the exciter field circuit, and allowing the generator voltage to build up from zero across the driving motors. A further opening of the engine throttle increases the generator voltage and, therefore, the car speed.

Interiors of both types of cars are of similar design

The two types of cars contain many similar features of design and construction. The bodies of both the 60-ft. and the articulated cars were built by the Ottawa Car Manufacturing Company and are of steel construction throughout. The interiors are finished in mahogany and



recently placed in service by the Canadian National

have a 5/16-in. Agasote ceiling painted in cream color. Double floors are applied throughout with the exception of the engine rooms where a single floor 1¼ in. thick, covered with checkered aluminum floor plates, is used. The floor consists of one layer of 13/16-in. white pine and a top floor of ⅝-in. fir, with a double thickness of building paper between. The side lining below the windows is 5/16-in. Agasote painted to match the interior finish. Both types of cars are equipped with single windows of cherry, to which storm sash can be applied for winter use. Three-ply Salamander insulation is applied below the windows, two-ply above the windows and one-ply on the ceiling. The roof boards are of ½-in.

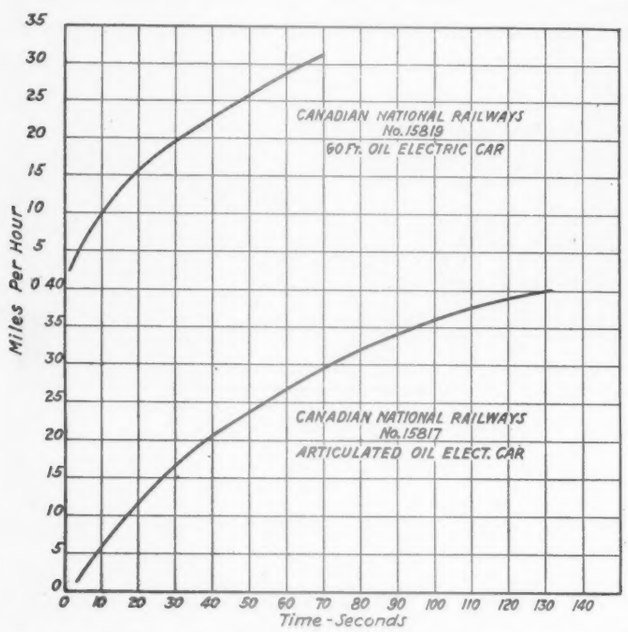


Chart showing acceleration curves for the 60-ft. and articulated cars on level track

whitewood covered with No. 6 canvas laid in white lead. Parcel racks running the full length of the passenger compartments are provided.

Electric lighting is provided from 30-volt storage batteries. Aluminum conduits for carrying the lighting circuits, power and control circuits are used throughout.

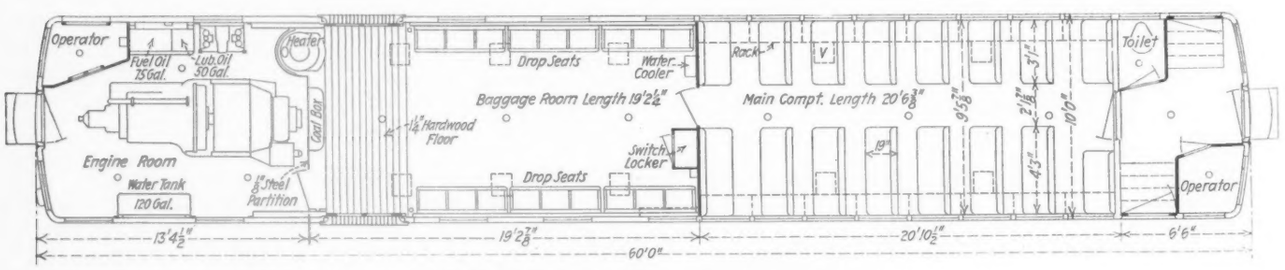
The articulated car has three-passenger seats

Each unit of the articulated cars consists of two bodies mounted on three four-wheel trucks. As shown in the floor plan of the articulated car, the front half contains the engine room, baggage room and smoking compartment which has a seating capacity of 35 persons. The

Interior view of the rear unit of the articulated car—The seats are designed for three passengers

rear half has a seating capacity of 91. The seats used in both compartments are of the Heywood-Wakefield reversible type, placed 2 ft. 7 in. center to center, and are upholstered in Spanish leather. Forty of the seats each accommodate three people while three seats provide for two passengers each, giving a total seating capacity for the articulated car of 126. The inside width is 10 ft. 4⅝ in. which permits the installation of seats 4 ft. 3 in. wide and allows an aisle space of 1 ft. 10⅝ in.

The length over the end sills of the front half of the articulated car is 51 ft. 3 in., and the length over the end sills of the rear half is 50 ft. 9 in. The overall height is 14 ft. 4⅜ in., and the width over the side sills is 10 ft. 10¾ in. The inside length of the engine room of the articulated car is 17 ft. 6 in., and the inside length of the baggage compartment is 16 ft. 6 in. The partitions



Floor plan of the 60-ft. motor rail car

Ventilation is provided by exhaust type ventilators in the roof. Smith hot water heaters are used for heating both types of cars. The 60-ft. car is equipped with one hot water heater which is placed in the baggage room. The articulated car has a heater located in the baggage room and one at the rear end of the passenger compartment. All of the pipes used in the heating system are of aluminum.

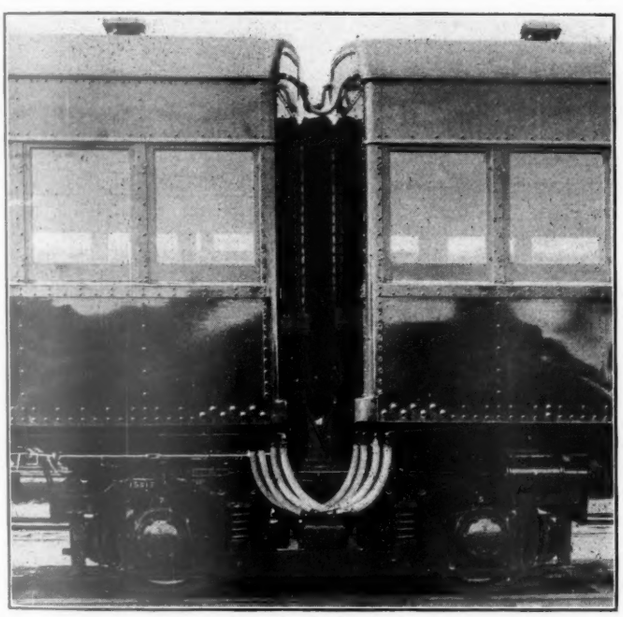
between the engine room and baggage room are of steel and are so constructed that they can be removed if necessary to work at the power unit. Roof hatches are provided directly over the engine and generator so that either may be removed by a crane for repair purposes. The hatch covers are provided with four ventilators operated from the engine room.

The three trucks of the articulated car are of Com-

monwealth design having 5-in. by 9-in. journals and 36-in. rolled steel wheels. The journals are equipped with S.K. F. self-alining roller bearings. Motors are mounted on the front and rear trucks only.

The center truck of the articulated car carries one end of both the front and rear body sections. Each section is provided with a special cast steel end sill to which are bolted center castings, one of which sets within the other, both engaging the truck center plate. A safety type locking pin is used, and safety bars are also provided. A one-piece canvas diaphragm encloses the space between the front and rear halves and a diamond steel foot plate is located at about the floor level.

The brake equipment is Westinghouse, schedule A.M.F. The air pressure on the articulated car is supplied by two DH-16 compressors connected in parallel. The braking ratios are based on 50-lb. cylinder pressure, being 83 per cent on the front and rear trucks and 75 per cent on the center truck. The trucks are equipped with the A.S.F. suburban type Simplex clasp brakes. The front and center trucks are fitted with a new design of brake which consists of a standard Type D freight brake cylinder mounted on each side of the truck frame and connected



Exterior view showing the center truck and connections between the two units of the articulated car

directly to the front brake gear. A flexible cylinder pipe connection is located near the center of the truck. On account of insufficient clearance, the cylinder for the rear truck is attached to the car body.

The sixty-foot car

The seats in the 60-ft. car are of the same design and manufacture as those of the articulated car. They accommodate three persons on one side and two on the other. In addition, the baggage room of this car is provided with drop seats of wooden construction giving a total seating capacity of 57.

The width over the side sills is 10 ft. which allows an inside width of 9 ft. 5⅞ in. The overall height is 15 ft. ¾ in. The distance between truck centers is 39 ft. 3 in. making a total wheel base length of 46 ft. 1 in.

Compressed air for the 60-ft. car is supplied by a General Electric CP28-D compressor. The braking ratio is 83 per cent based on 50-lb. cylinder pressure. The trucks are equipped with single shoe type brake with the standard body brake arrangements. They have 36-in. rolled steel wheels, A.R.A. boxes and brasses, cast steel side frames and built-up bolsters. The front truck carries two motors and has 5-in. by 9-in. journals. No motors are used on the rear truck which is equipped with 4¼-in. by 8-in. journals.

Both cars are equipped with the Universal Draft Gear Attachment Company's hand-brake booster and vertical operating ratchet handle. The standard train air communicating signal system is used.

A 12-in. Golden-Glow headlight is mounted on the roof at each end of each car. The Canadian National standard number lamps and Strombos horns are also provided, as shown in one of the illustrations. Miniere window cleaners are installed on the front window of each operator's room. Each car is equipped with a listening tube which runs from the engine room to the rear operating room. Sand boxes are suspended from the underframe and are filled through holes in the car floor. Hanlon sanders provide sand to the front of the front truck and to the rear of the rear truck.

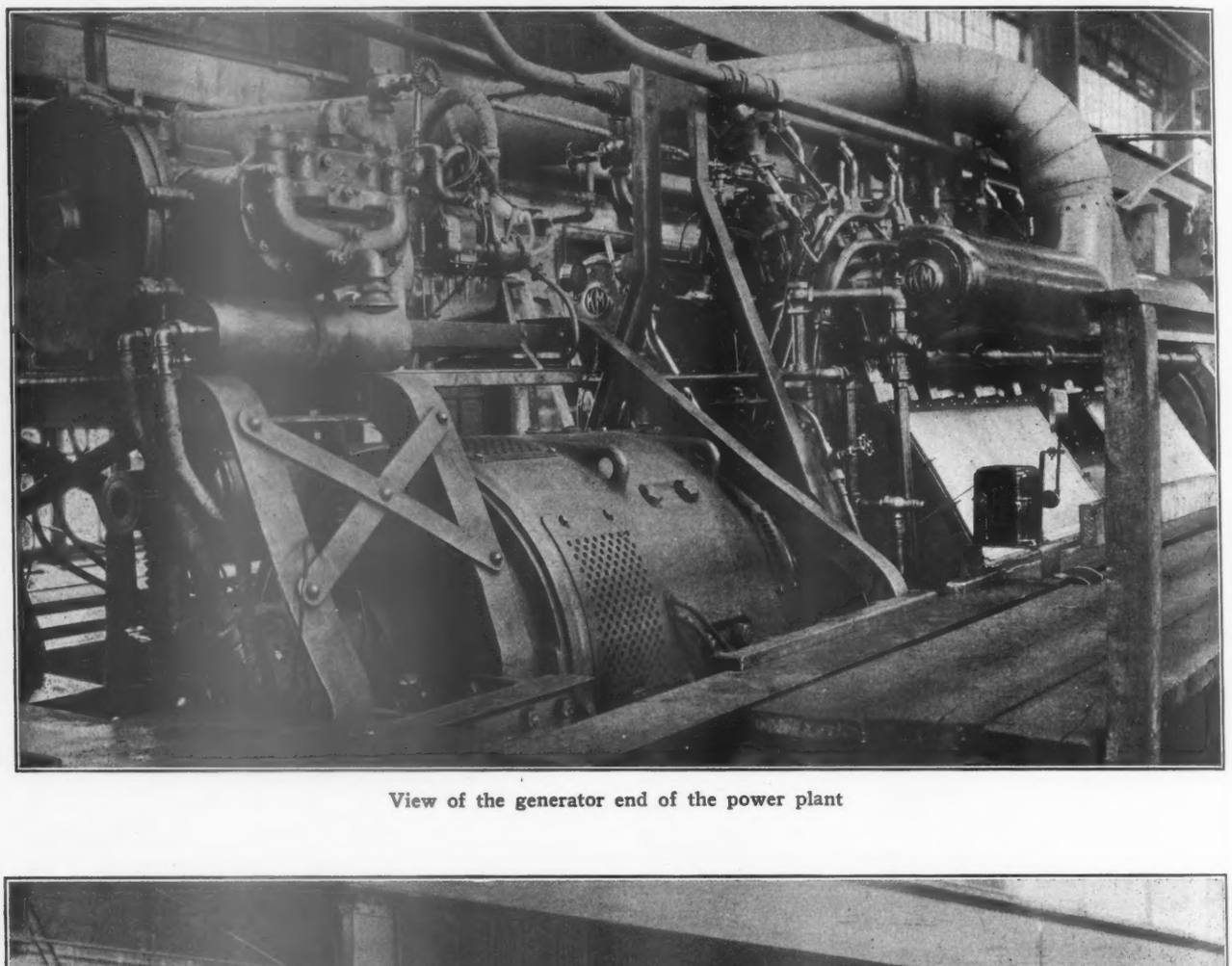
It is reported that both cars have attained a speed on level track of approximately 60 miles per hour and show a low fuel consumption. Both cars have sufficient power to handle a trailer over an average profile at a proportionally reduced speed. Car accelerations up to 40 and 30 miles per hour respectively have been made in actual test.

Principal dimensions and proportions of the Canadian National Diesel-electric cars

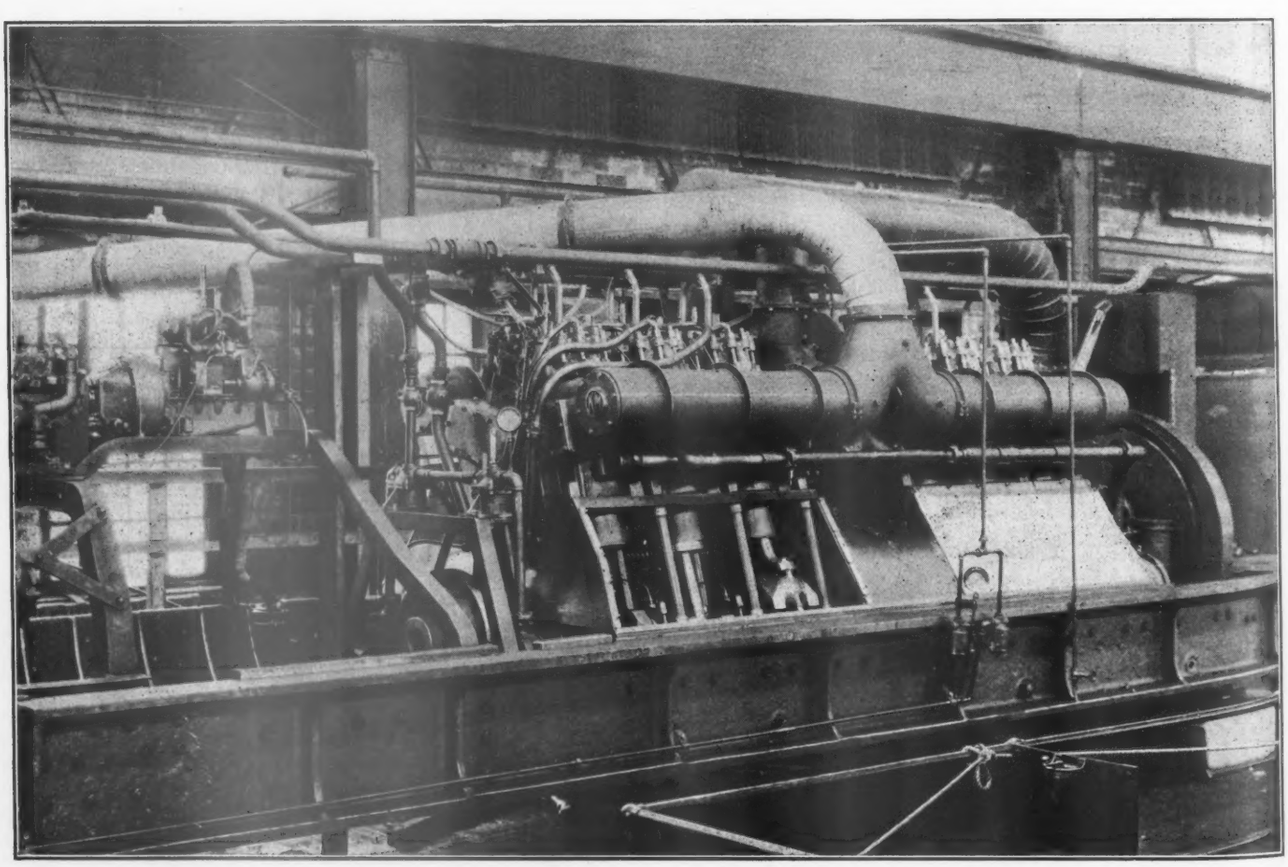
	60 ft. cars	Articulated cars
Builder	Canadian National	Canadian National
Type	Diesel-electric	Diesel-electric
Total weight	101,000 lb.	188,000 lb.
Total wheel base	46 ft. 1 in.	85 ft. 10 in.
Diesel engine:		
Builder	William Beardmore & Co., Ltd.	William Beardmore & Co., Ltd.
Type	4 cyl., 4 cycle	8 cyl., 4 cycle
Rated capacity	185 b.hp. at 700 r.p.m.	340 b.hp. at 650 r.p.m.
Cylinders, diameter and stroke	8¼ in. by 12 in.	8¼ in. by 12 in.
Weight	2,750 lb.	5,450 lb.
Generator:		
Type	Thomson – Houston, 105 kw. d.c.	Westinghouse 200 kw. d.c.
Voltage	600	600
Motors:		
Number	2	4
Type	General Electric Type 240-A	Westinghouse, 200 hp.
Capacity of fuel tanks	75 gal.	150 gal.
Length over couplers	60 ft.	102 ft.
Width, inside	9 ft. 5⅞ in.	10 ft. 4⅝ in.
Height, overall	15 ft. ¾ in.	15 ft. 4⅜ in.
Diameter of wheels	36 in.	36 in.
Size of journals	5 in. by 9 in., front truck, 4½ in. by 8 in., rear truck	5 in. by 9 in.
Total seating capacity	57	126

THE FEDERAL DISTRICT COURT for eastern New York holds that under the Boiler Inspection Act each day of use of a locomotive with a defective boiler is a separate violation of the statute.—U. S. v. L. I., 4 Fed. (2d) 750.

THE AVERAGE COST OF COAL for road locomotives in freight and passenger train service (charged to operating expenses) in May was $2.73 a ton, as compared with $3.07 for May, 1924, and $2.80 for the first five months of 1925, according to the monthly statement compiled by the Interstate Commerce Commission. The cost of fuel oil per gallon, however, was 3.24 cents as compared with 2.86 cents last May and the total cost of coal and fuel oil for the month was $25,880,953, as compared with $28,014,369 last May. For the five months' period the total cost of coal and fuel oil was $138,683,648, as compared with $160,251,663 last year.



View of the generator end of the power plant



View of the engine mounted on the cast steel girders, showing the scavenging air blower at the right

Diesel-electric locomotive built by Baldwin

The twelve-cylinder engine develops 1,000 *horsepower—*
The rated maximum tractive force is 52,200 *lb.*

A DIESEL-ELECTRIC locomotive has been built by the Baldwin Locomotive Works, Philadelphia, Pa., which has the largest horsepower capacity of any internal combustion locomotive yet built in this country.

The rated maximum tractive force of the locomotive is 52,200 lb., the oil engine having a rated capacity of 1,000 hp. The total weight of the locomotive is 275,000 lb., of which 180,000 lb. is carried on the driving wheels. The total length over the couplers is 52 ft. 1¾ in. The locomotive has a total wheel base of 38 ft. 4 in. and a rigid wheel base of 12 ft. 8 in. The electric transmission consists of four Westinghouse type 353-D-3, standard railroad type, self-ventilating 200-hp. motors which are geared to the driving axles through flexible gearing. Power is furnished to these motors by a Westinghouse self-ventilating, direct current generator and exciter directly connected to the engine.

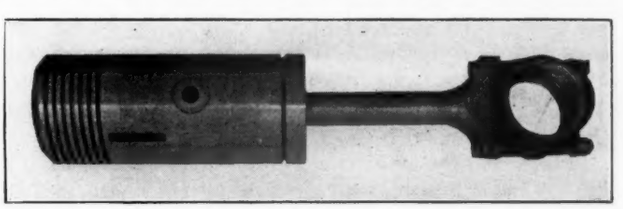
Referring to the illustration showing the side view of the locomotive, it will be noted that the general appearance is similar in many respects to that of an electric locomotive. The cab is of all-steel construction and extends the entire length of the frame. The height from the rail to the top of the cab is 14 ft. 7 in. and the width overall is 10 ft. 5 in.

The power plant of the locomotive is carried on two six-wheel trucks, each made up of the usual locomotive type bar frames in the pedestals of which are mounted outside journal boxes of three pairs of wheels. The two motors in each truck are geared to the outside axles, the middle pair of wheels running idle. The power plant, consisting of the oil engine, the direct-connected generator and the auxiliaries, is carried on two longitudinal cast steel girders which are connected by cast steel cross-ties at each end. These cross-ties also contain the center pins which engage the center plates of the two motor trucks. The drawbar pull is transmitted from one truck to the other through a drawbar and radial buffer construction at the inner ends of the two trucks, of a type commonly used in electric locomotive design.

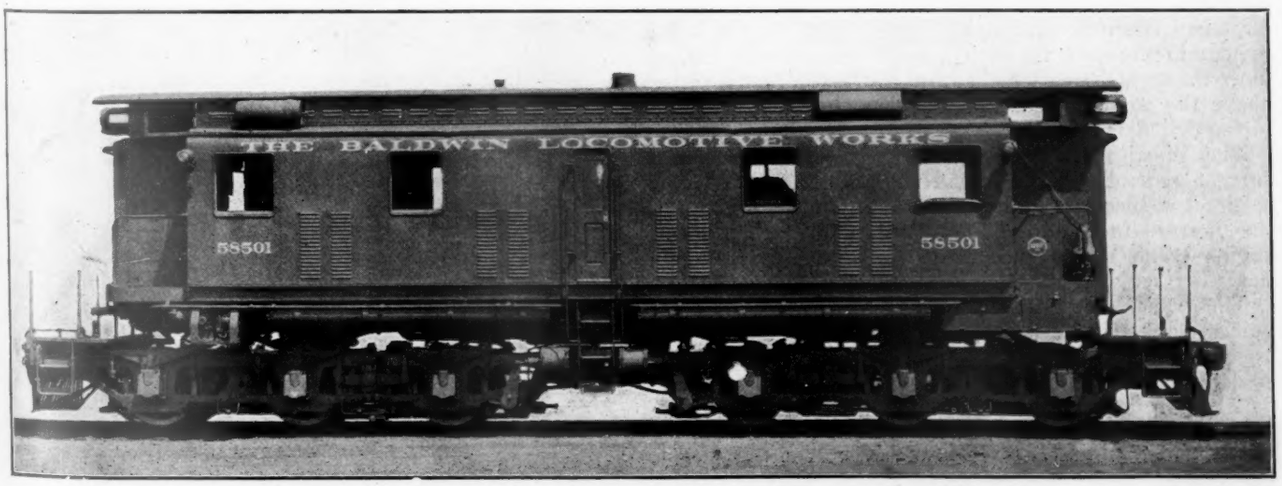
A feature in the design of this locomotive is the arrangement of the spring rigging which has been patented by the builder. Two springs are placed over each box, one on the inside and one on the outside of the frame, each resting directly on top of the journal box and connected with each other by short cross equalizers at each fixed attachment to the frames. These equalizers allow for any variation in the height or deflection of the two springs which act together. Placing the spring alongside of, instead of over the top of the frame as would be required by the usual arrangement of one spring for each journal box, permits the lowering of the center of gravity of the locomotive at least six inches and also permits a corresponding increase in the headroom in the cab.

The Diesel engine

The oil engine, which is of the two-cycle solid injection type, was built entirely in the shops of the Baldwin Locomotive Works according to an arrangement with the Knudsen Motor Corporation, New York. There are twelve cylinders arranged in two groups of three pairs each, the pistons in the two cylinders of each pair driving on separate parallel crank shafts. Each pair of cylinders, however, has a common combustion space,



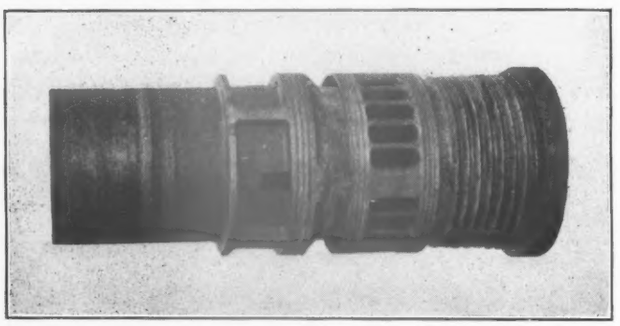
The head of each piston is provided with a long port to permit the entrance of air for cooling



1,000-hp. Diesel-electric locomotive built by the Baldwin Locomotive Works

enclosed by a single head casting and supplied with fuel through a single injection nozzle. The six fuel pumps, one for each combustion chamber, are operated by a cam shaft. In the center of each of the two crank shafts, between the two groups of cylinders, is a large herring-bone gear, the gears from the two shafts meshing with a herring-bone pinion on the end of the generator shaft which steps up the crank shaft speed of 450 r.p.m. to 1,200 r.p.m. at the generator.

The cylinders, which have a diameter of 9¾ in. and a stroke of 13½ in., contain the ports usual in two-cycle internal combustion engines near the end of the stroke. The gears, which keep the two crank shafts in constant angular relationship, are so meshed that the pistons on one side of the engine are in slight angular advance in relation to those on the other side. Through the ports in these cylinders the exhaust takes place, to be followed by the admission of scavenging air from a manifold connected to the corresponding ports on the other side of the engine. The scavenging air thus enters through the ports in one cylinder and passes up through that cylinder, down through the other and out through the exhaust ports once in each revolution. On the return stroke the piston on the exhaust side of each pair of cylinders closes the exhaust ports slightly in advance of the closing of the air intake ports of the other cylinder so that scavenging air, which is delivered by a



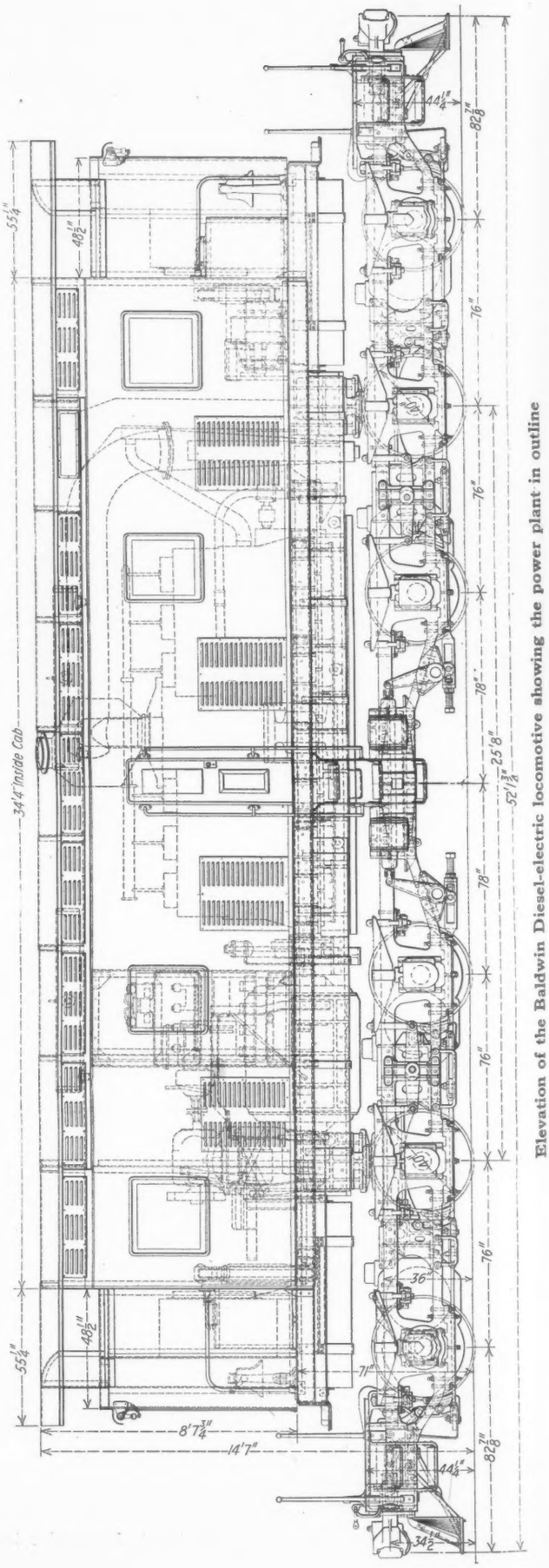
View of the cylinder showing the ports used for scavenging and for piston cooling air

blower at about 2½ lb. pressure, builds up to this pressure in the cylinders before the intake port closes and compression begins. In this way a degree of super-charging is effected which materially increases the amount of power that may be developed in a given cylinder volume.

Another special feature of the engine lies in the port openings in the cylinder and piston walls which permit air taken from the scavenging blower and boosted a few ounces in pressure through a small gear-driven fan, to blow through the closed chamber in the top of the piston above the wrist pin and mingle with the scavenging air in the cylinders, the purpose being to cool the pistons.

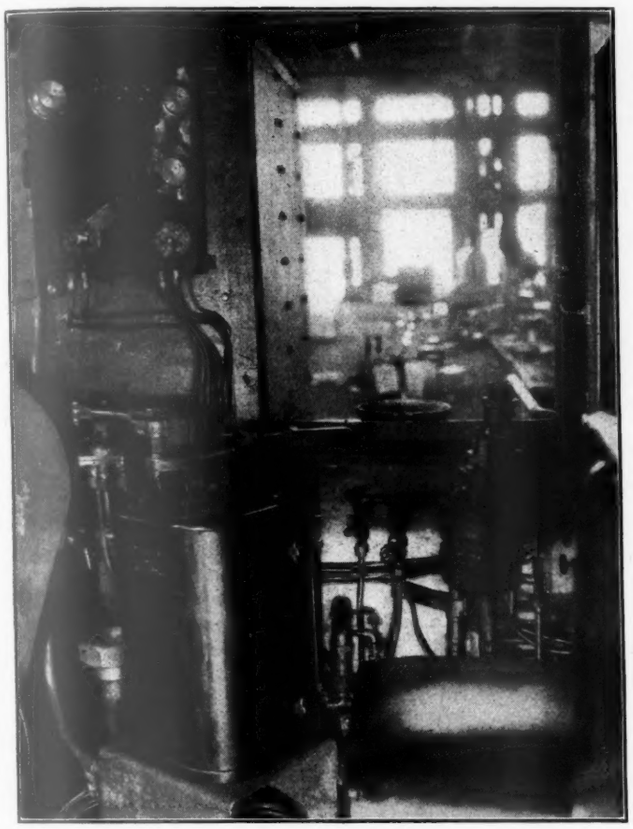
The Westinghouse 750-kw., separately excited, direct current generator develops 750 volts at 1,200 r.p.m., and is direct connected to the step-up shaft of the oil engine, the increase in the speed of this shaft over that of the engine crank shafts permitting a material reduction in the generator weight.

The principal auxiliaries which form a part of the power plant are the scavenging blower, the water cooling system and the air compressors. The scavenging air is delivered by a centrifugal blower which is driven at 3,600 r.p.m. by a gear connection to an extension of the generator shaft. This blower has a capacity of 4,500 cu. ft. of air per minute at 2½ lb. pressure. The water cooling system, which was designed by the Modine Manufacturing Company, Racine, Wis., consists of two radiators, one built into each end of the locomotive cab, the



Elevation of the Baldwin Diesel-electric locomotive showing the power plant in outline

water being circulated by a gear pump driven from the engine shaft. Air is circulated through each radiator by a fan, the fan at the front end of the locomotive being driven mechanically from the engine shaft, while that at the rear end opposite the generator is motor driven.



Interior view of the cab showing one of the control stations

The locomotive is equipped with three Westinghouse motor-driven traction air compressors. One of these is suspended under the cab at each end of the locomotive, while the third is mounted in the cab over the generator. Connected by means of a clutch to an extension of the motor shaft of this compressor is a small four-cylinder gasoline engine which is used in starting the locomotive to build up a main reservoir pressure of about 120 lb. to supply air to turn over the Diesel engine the few revolutions required before combustion takes place in the cylinders. The gas engine is then declutched and stopped, the compressor continuing to operate as a motor-driven unit under the same automatic control as the other two units.

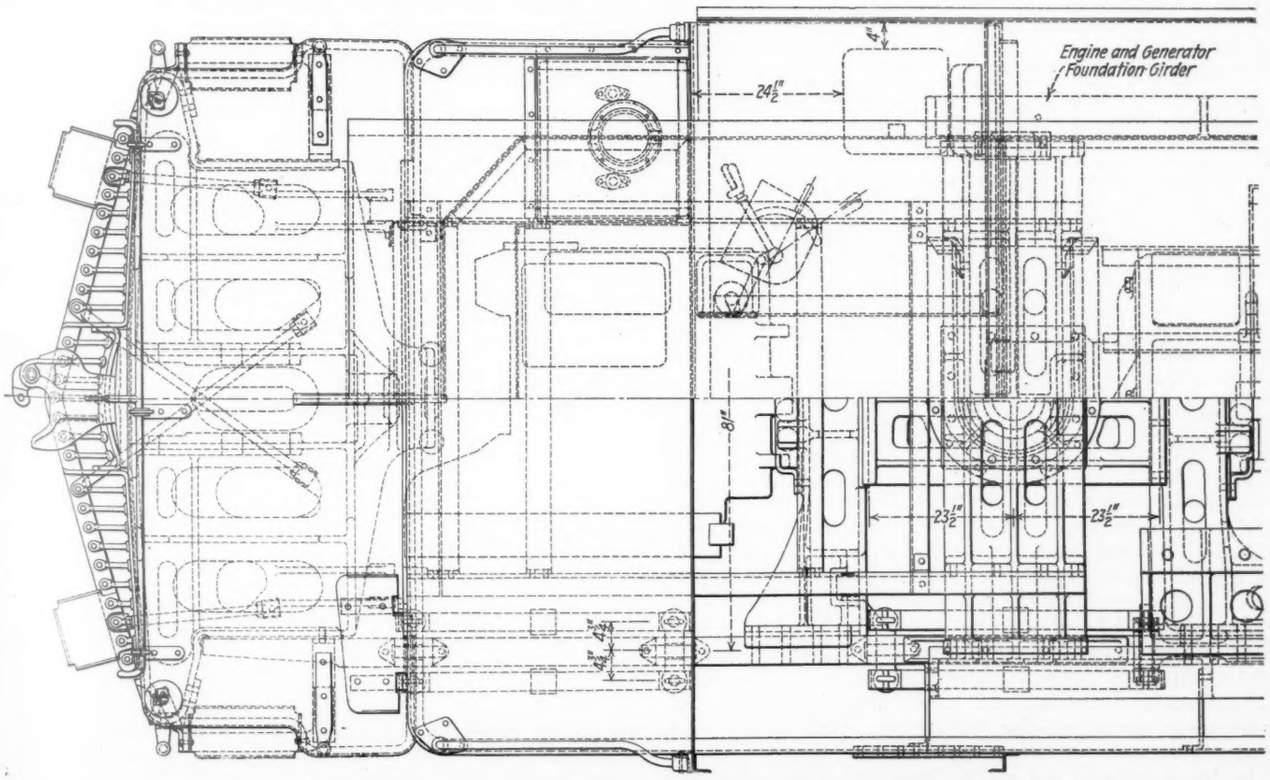
The starting system consists of six air distributing valves operated by the cam shaft, each admitting air to its pair of cylinders through a check valve in the cylinder head. A single throttle admits air to all the distributing valves when the motor is to be started.

The lubrication of the engine is a combination of the force feed and splash systems, the oil circulating pump being driven mechanically from the engine shaft.

The control equipment

The control equipment, which is of the Westinghouse electro-pneumatic type, is arranged for double end operation of the locomotive. With the Diesel engine and generator running at a constant speed, the locomotive is accelerated from standstill by the manipulation of a master controller, shown in one of the illustrations, by which the voltage of the generator is increased in steps, through field control, as the speed of the locomotive increases. With full generator voltage for a given generator speed developed in this way, further acceleration is effected by increasing the Diesel engine speed and, hence, the generator power output. The oil engine throttle is controlled by the manipulation of a valve handle on the master controller, which permits the increase or decrease of oil pressure in a cylinder, the piston of which, in moving out-

Elevation of the Baldwin Diesel-electric locomotive showing the power plant in outline



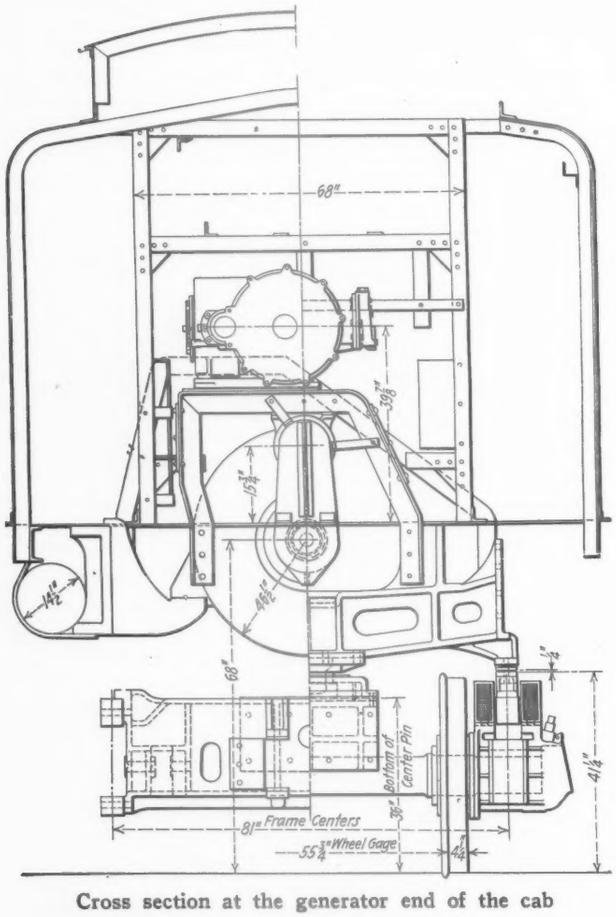
Partial plan of the locomotive showing the end construction of the power plant foundation

ward, compresses the governor springs. The throttle thus controls the speed at which the governor operates to reduce the stroke of the oil injection pump pistons. The unusual feature of this throttle control from the operator's standpoint, lies in the fact that it is manipulated to admit or release oil, supplied at constant pressure, to or from the control cylinder, only long enough to produce the desired engine speed, and is then brought to lap position until another change of power output is required.

Service trials

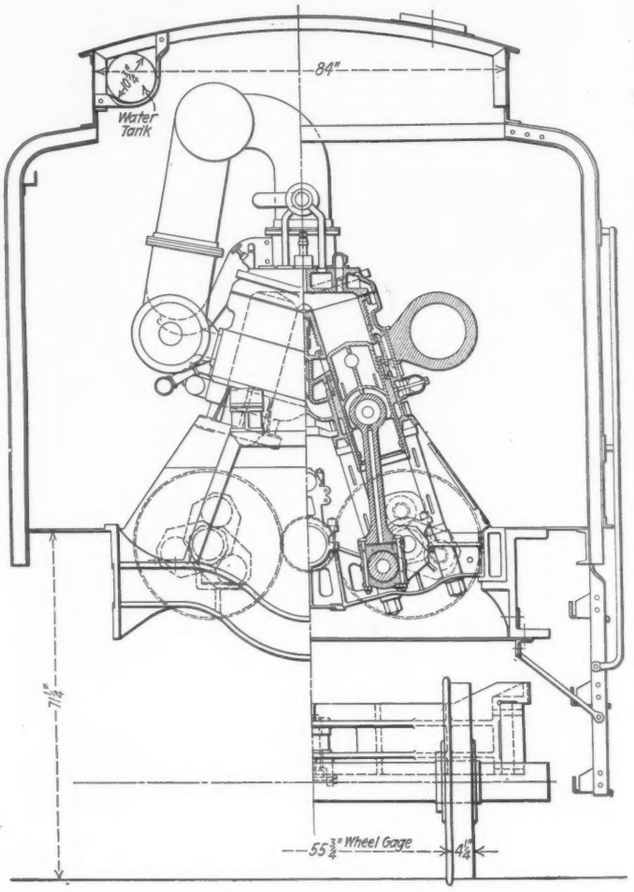
The locomotive, which was built in June, 1925, has for some time been in service on the Reading, part of the time in road freight service, between Reading, Pa., and Tamaqua, and part of the time in yard service. In both services the locomotive has given a good account of itself from a mechanical and power standpoint, the high tractive force characteristic of a constant power output machine adapting it particularly well to heavy switching service.

While no attempt has yet been made to test the locomotive accurately in actual service, the following operating results have been obtained. The locomotive has handled 1,000-ton trains from Reading to Tamaqua, a distance of approximately 40 miles, about three-quarters of which is upgrade at the rate of about .7 per cent with an average of 3.3 gal. of fuel oil per 1,000 gross ton-miles. It has moved these trains over the grade at a speed of approximately 16 miles an hour. On the runs in the reverse direction, with 2,000-ton trains, the fuel consumption averaged one gallon per 1,000 gross ton-miles.



Cross section at the generator end of the cab

The block tests of the engine indicate a fuel consumption of .40 lb. per horsepower hour at full load, increasing to .45 lb. per horsepower hour at half load. The engine has developed a maximum crank shaft speed of 480 r.p.m. It operates smoothly with very little vibration.

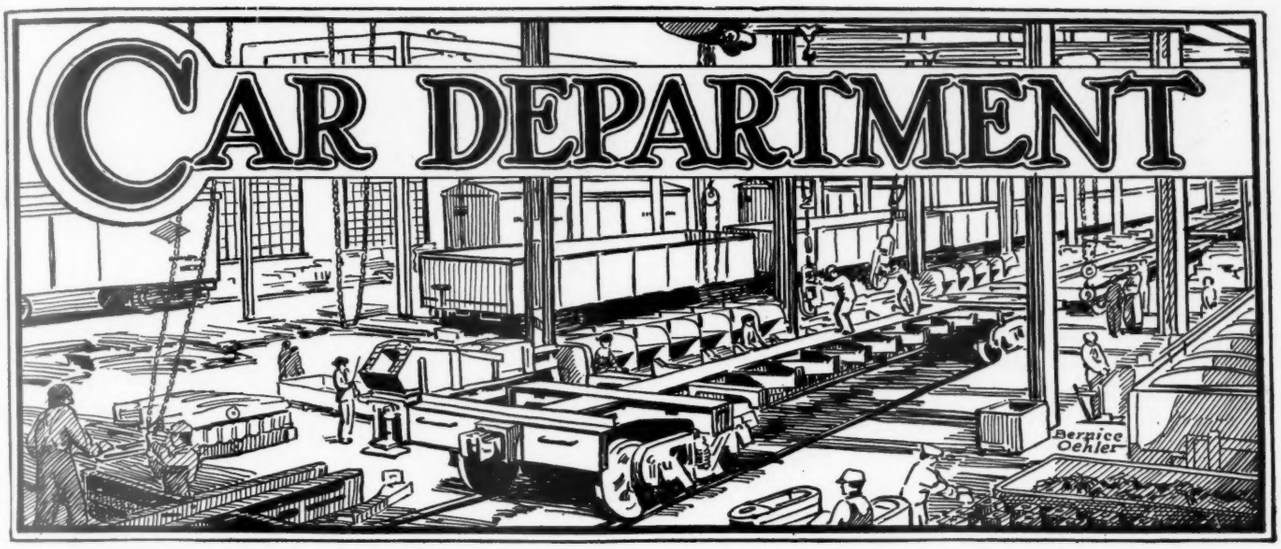


Cross section through the locomotive, showing a section through one of the oil-engine cylinders—the scavenging air manifold is shown at the left and a section through the exhaust manifold is shown at the right

Principal dimensions and proportions of the Baldwin Diesel-electric locomotive

Builder	Baldwin Locomotive Works
Type	Diesel-electric
Weights on drivers	180,000 lb.
Total weight	275,000 lb.
Wheel bases:	
Truck	12 ft. 8 in.
Total locomotive	30 ft. 4 in.
Diesel engine:	
Type	Knudsen, 12 cyl., 2 cycle
Rated capacity	1,000 hp.
Cylinders, diameter and stroke	9¾ in. by 13½ in.
Generator:	
Type	Westinghouse, 750 kw. d.c.
Voltage	750
Motors:	
Number	4
Type	Westinghouse, Type 353-D-3, 200 hp.
Capacity of fuel tanks	750 gal.
Length over couplers	52 ft. 1¾ in.
Diameter of wheels	40 in.
Size of journals	7½ in. by 14 in.

The Bureau of Locomotive Inspection of the Interstate Commerce Commission in September inspected 6,556 locomotives, of which 2,835 were found defective and 302 were ordered out of service, according to the Interstate Commerce Commission's monthly report to the President on the condition of railroad equipment. The Bureau of Safety inspected 120,242 freight cars, of which 4,705 were found defective, and 2,175 passenger cars, of which 30 were found defective.



Testing paint by the removed film method

The presence of inferior bases and reducing oils can be easily determined—Tests of new stock prevent waste

ABSTRACTS of a number of papers presented at the fourth annual meeting of the Equipment Painting Section of the Mechanical Division, American Railway Association, held at St. Paul, Minn., the week of September 14, were published in the October issue of the *Railway Mechanical Engineer,* page 635. Following are abstracts of a paper and a committee report on the general subject of paint testing.

Is testing paint stock a useless innovation?

By W. O. Quest
Foreman painter, P. & L. E., McKees Rocks, Pa.

In all trade craft activities, new methods, ideas and materials are rapidly advancing. The paint craft is facing its share of an endless introduction of the by-product discoveries developed by alleged scientific research and doubtful authorities. Seemingly strange, bad and very bad paint stock threaten to keep the craft guessing and in order to feel safe, the future painter will possibly be compelled to study chemistry before claiming to know his business thoroughly.

This threatened future study of the chemistry of paint is also a vivid reminder of the activities of the late C. B. Dudley, chief chemist, Pennsylvania, Altoona, Pa., who decided that all new paint and varnish stock or formula should be tested through the medium of applied and removed films instead of by the separate raw material analysis before combining.

During the years of the writer's experience, oils, paints, varnishes, lacquers, liquid wax reducers, tars, etc., were removed and put on the "judgment drying line," with varied and surprising oxidizing results. Some of the best looking and working combinations when hung up would become brittle and fall off in a few days; others would soften up and, ribbon like, badly stretch down, showing other extremes of the freakish nature and action of the impracticably combined paint stock.

Until time made him wise to the unlimited deviltries of some paint offerings on the market, the writer was much exercised in finding formulas for paint that were soluble in water in the floating off process. In several such experiences, the water solubility action was so great that the removed film was almost reduced back to the liquid state. There were a number of instances where the watersoaked films turned white and failed to dry out normally as any pure paint stock should. As this phase of the trouble usually followed some claimed "world beating new stuff," he decided the cause to be a soapy over-oxidation of some water, sensitive over-emulsionized greases or other like matter, or through the use of some burnt-up precipitated kettle bottoms, called carbon waxes or gums susceptible to water contact. As this trouble was found repeatedly in film tests, it can readily be seen what would be sure to happen, and does happen, when such water permeating paint bases are weather exposed as a protective paint.

There were first class, honestly manufactured gum-bodied reducing oils that retained their elasticity through the removed film tests. There were also similar appearing oils and handling oils found to be absolutely worthless for any protective paint purpose. As an old-timer, the writer was pleased to find that for craft convenience, critical safety, etc., linseed oil would always show its presence; that the best substitutes were always linseed oil based; that in combinations, commercially pure, or in its most perfect refined "lin-oxylin form," it would show

up in the film tests with such gratifying results that he was thankful there was such a reliable, generally accepted material as linseed oil.

There seemingly is no limit to the fixed base substitute and reducing paint oil production. Some of the offerings were so gelatinous that they would liver up, waxlike, beyond the possibilities of further reducing out; others would drop their essential drying matter, slowing up the reducer of the sample. In the tests the substitute lower grade of oils would always throw off more volatile matter.

The principal substitutes filmed were selected as known to be generally used in combination or as straight substitutes for linseed. In order to be fair, the filmed base substituted oils were all used raw and ground in the same grade of pigment and also the proportion of special japan or other reducing matter.

Bodied-up cotton, corn, peanut, rape, parrilla, fixed pine and several mystery oils were pigment based and filmed. The parrilla made the best body showing but was hard to handle, notwithstanding that it is claimed to be linseed's nearest rival, and possibly is, if skillfully handled.

Mineral oils, in the film tests, were a source of many hard efforts and disappointments. For test purposes, the finest samples procurable were used, including beautiful bodied oils which were air-blown, acid-neutralized, deblumed, grease-rectified, etc., especially fixed for protective paint-making. They would seemingly build up fairly well in the coating process but when it came to floating them off, the paint body would sweat away leaving nothing viscous but a glaze of under dried-on admixtures to float off.

Grease oils—We will only include in this paper the commercially known and used heavy-bodied fish oils, which in film making are handled very much like heavy-bodied linseed. When filmed, the better grades of refined fish oil would build up a heavy film with less coats than any of the other oils under test. The method of handling the fish oils was similar to all other oils: by applying with a brush, repeating the coatings. When the desired number of coats were on, the films were racked until ready to float off. These always required more drying time than the best and worst of the lighter bodied oil substitutes. But, as the drying power of the japans used was the principal object of interest in the grease-oil tests, there was little attention paid to the slower oxidation of the fish oil racked films. Many of the films of the better grades of refined fish oils were beautiful in body and appearance. In the impracticable slow-drying tests, the record kept showed that there was but little volatile loss. As the oils had not been excessively heat-combined with other material, the films had but little tac. Taking the oil tests all together, it is predicted that the future best fixed paint oil for protective paints will include the refined fish oil as an oxidizing retarder that will give results not experienced today in protective paint for structural metai. The writer is convinced of this and also predicts that the use of any kind of oil in combination, when studied out, will make the manufactured combined oil the best on a staple priced market. The desired combined oil will be a viscous quick set-up, in order that it may be used safely by heavy brush or mechanical application without the prejudice usually encountered today. There will be no excessive thinning or rubbing out. The applied body of protective paint will be a tough elastic film, oxidizing from the bottom out which cannot be had by a light-bodied paint unless at unnecessary labor cost. It will not be a question as to how much a gallon of paint will cover, but how long it will last.

Varnish films—As a good grade of varnish is usually tough and elastic, there is never any trouble in floating off. A pure linseed, hard or soft fossil gum combination, will turn white when floated off, but will naturally dry on a line in a day or two. In removing varnish films, if large, they must be stripped squarely with the wood along the top, so as to prevent the water-softened film from sagging irregularly while drying on the line. A small film of two or three coats is sufficient for a shop paint or varnish test. For large reference tests, to be handled repeatedly, apply eight or ten coats according to the weight of the varnish filmed. The oxidizing loss in making varnish films was found to be from 50 to 60 per cent. The protective paint loss will average about 33 per cent.

Shellac films—Shellac films were made to detect the purity of the gums. It was discovered that the smelly, so-called mineral distillate denatured alcohol, made a tougher wearing shellac and retarded the drying but slightly. It also helped the working qualities, owing to its slower volatility which was very noticeable in film tests and considerably so when compared with the films made with wood alcohol, denatured alcohol, or the grain proof, spirit quick volatiles. A film made from pure hard gum shellac will not stretch much on the line. An adulterated soft gum will stretch and may ruin the test film. All shellac films, owing to taking up oxygen on both sides on removal, soon become brittle with but little time variation.

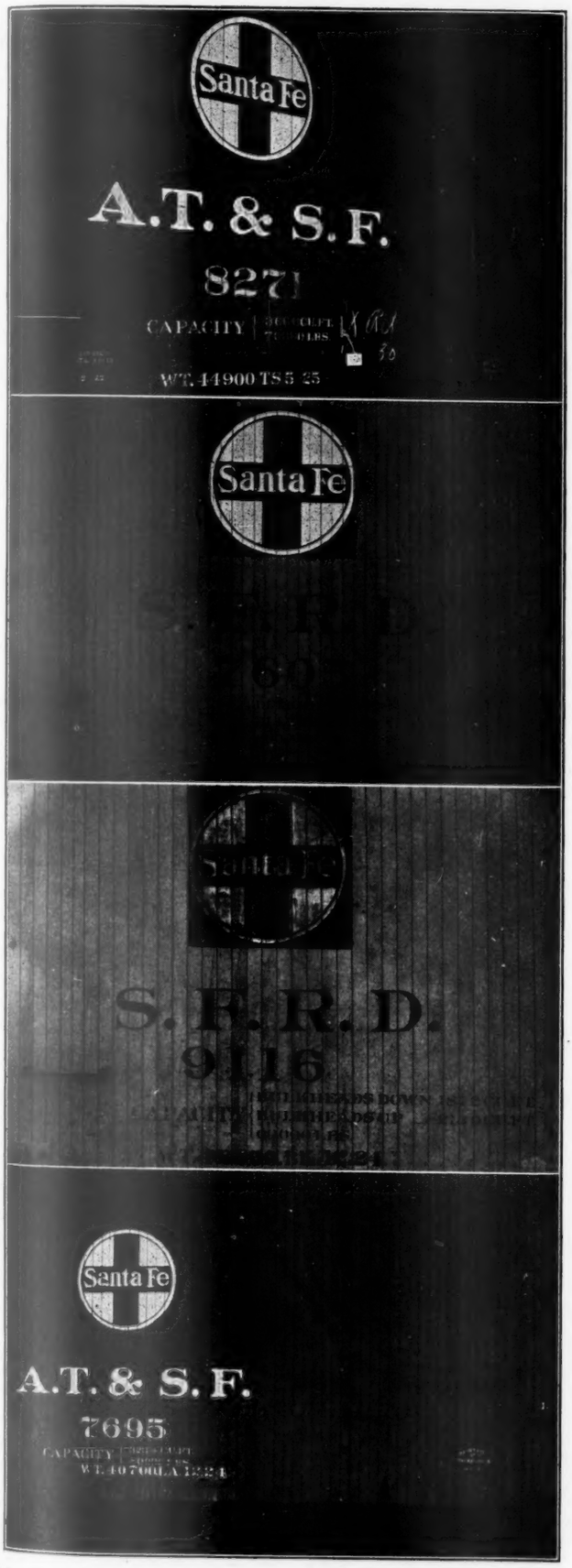
Lacquers—In the old days of the brass-trimmed coach, films were made in the buffing and plating department of what was called dipping and baking lacquers, in order to ascertain the body weight of competitive priced lacquer offerings. The more recent introduction of kindred lacquer specialties, designed for weather exposure in the form of a complete quick surfacing system, and complete finishes, threatens to displace the old-time paint and varnish surfacing systems, as is indicated today by its large and rapidly increasing use in automobile and like surface paintings. It evidently is making good in the demand for quicker surfacing methods.

Damar varnish—The purity and elastic quality of Damar varnish can be film tested like shellac gum. If material other than hard Batavia gum is used, the softer adulterant gums will show granulation in the water floating-off process, through the film's wet surface which to the eye will disappear when dried out. Without essential binding admixtures, such stuff is not fit to use for any purpose, as the best hard-gum Damar varnish made is not any too good in a car paint shop.

Tar films—Natural and manufactured tar films were taken off to ascertain their protective and fire-repelling qualities. Commercial preparations as well as shop-prepared products of good coal tars further reduced in viscosity by a gentle heat evaporation to eliminate the ammonia as much as possible, were the carrying vehicles, with a little fish-oil as a binder and slow-up. Asbestos and magnesia fibre, in dust form, were used freely as the proposed fire-proofing material. A heavy one-coat paste was usually knifed on. As both natural and manufactured tars are heat by-products, the fire-resisting qualities of the removed films were wonderful, especially in locomotive spark and cinder abrasion resistance, but the sterling worth of the tar coatings, owing to the appearance, did not meet with official recognition at that time.

How to make films

The method and equipment for making films is very simple. A shallow water-tight box of a size to float off the largest film wanted, consists of square frames made of wood strips two inches wide and of any desired length. It is covered with tightly stretched cheesecloth and tacked along the edges; then smooth-surfaced stout paper is



Examples of box car lettering submitted to show the comparative weathering qualities of titanox and white lead paint

tacked over the cloth. Several coats of glue sizing, of about five ounces of dextrine, fish, white, or other light colored glue to the gallon of water, is then heated and applied with a brush. There should be no runs or missing in applying the sizing. For making small shop films, plates of glass or tin which have been wiped dry with oil or vaseline, may be used, but there is liable to be trouble in pulling the films off.

Report of the Committee on Tests

This committee suggests that the film test has a value that will warrant its careful study. The paint pigment action on oil can be settled in a few years by aid of the removed film test to the satisfaction of the interested craftsmen that do or do not believe that paint failures can be charged to suspected pigments and that they actually destroy the oil. The problem should be settled beyond all doubt by the consistent outdoor exposure of removed films, owing to the fact that the exposed film is taking in oxygen from both sides which rapidly determines any deteriorating pigment action on oil.

Substitute for shellac

The committee tested several substitutes for shellac and has not as yet found one that compares favorably for all purposes and all classes of work. Shellac is used for so many different purposes—that the procurement of one grade of material which will meet all requirements is an advantage.

Spirit lacquer is a spirit varnish intended to do the work of shellac for first coating, sealing and priming purposes. It is made of fossil gum and high proof alcohol. It may be used for brush, mechanical or dip work. It is recommended that this material be given special study by the committee next year.

Substitutes for white lead

Titanox—In a minority report of the test committee last year, a report was made on titanox, describing its composition and tests were submitted to prove its superior whiteness and covering power. It was evident that there were only a few in the convention that had any experience with this material and the subject was referred to the test committee for further experiments.

Your committee reports that from information obtained from widely separated points, it is generally agreed that titanox is far better in covering power than white lead. It covers about one-third more surface than white lead.

At the Topeka shops of the Atchison, Topeka & Santa Fe, titanox has been standard for over two years for stencilling freight equipment and for the painting of railroad crossing signs, whistling posts, ceilings of baggage and mail cars, interiors of dining cars, kitchen and pantry, as well as other places where a first class durable white paint is desired. The illustration is submitted as evidence of the durability of titanox, as well as of its clear white color as compared to lead. Car, S. F. R. D. No. 7,605, shows a Santa Fe monogram which was mechanically painted with titanox in March, 1924; Car S. F. R. D. No. 9,116, was stencilled with white lead by brush in December, 1924, in Bakersfield, Cal. Box car No. 7,695 shows the monogram initials of the road in mechanically applied titanox, the number and other stencilling was stencilled with lead applied by brush. This car was painted and stencilled in November, 1923, at Topeka, Kan., as you will note by the stencil to the left of the car door. You will also note that the latest light weight was stencilled on in Los Angeles, Cal., December, 1924.

We know that acid fumes will darken white lead. No

reliable contractor will use it in the interior of kitchens and expect it to retain its color.

The good points of titanox paints were outlined in the preceding paragraphs. The following are what might be termed the weak points. A mixture of the two component parts that compose titanox; namely, titanium oxide and barium sulphate, require reinforcing with zinc and other materials to get the best results. When applied by themselves they dry very slowly and chalk freely. Titanox paint will not sandpaper as easily as lead, but the dust has no poisonous effect on the workmen.

B. E. Miller of this committee, reports that he received some titanox that turned a light pink or brownish cast when used in stencilling freight equipment. In the opinion of your committee, this is not common in titanox, as the illustration clearly proves, and after diligent inquiry we can find only one other instance where free iron was found in the pigment. This is reported by W. O. Quest, who states that in the great amount of this material he has used and tested he only found one small batch that contained iron, and a short time after application it had the same discoloration as that reported by Mr. Miller.

There has been doubt in the minds of some whether or not this material is as cheap as white lead. When we consider that the difference in cost per pound in paste form is only from 2 to 2½ cents, and that it is generally conceded that a 100 lb. of titanox will make at least one gallon more paint than 100 lb. of white lead and that this mixture will cover a third more surface than the white lead, your committee can see no reason why paints with a titanox base should not be given preference for many purposes over those containing white lead.

Table showing the kind of material applied to each panel and the time allowed for drying

Panel No.	First coat	Second coat	Third coat	Drying first coat, hours	Drying second coat, hours	Drying third coat, hours
1	Red lead straight	Red lead straight	Red lead straight	48	48	48
2	Red lead extended 25%	Red lead extended 25%	Red lead extended 25%	48	48	48
3	Red lead extended 50%	Red lead extended 50%	Red lead extended 50%	48	48	48
4	Lamp black straight	Lamp black straight	Lamp black straight	48	72	72
5	Lamp black extended 25%	Lamp black extended 25%	Lamp black extended 25%	48	48	48
6	Lamp black extended 50%	Lamp black extended 50%	Lamp black extended 50%	48	48	48
7	Iron oxide straight	Iron oxide straight	Iron oxide straight	48	48	48
8	Iron oxide extended 25%	Iron oxide extended 25%	Iron oxide extended 25%	48	48	48
9	Iron oxide extended 50%	Iron oxide extended 50%	Iron oxide extended 50%	48	48	48
10	Blue lead straight	Blue lead straight	Blue lead straight	48	72	72
11	Blue lead extended 25%	Blue lead extended 25%	Blue lead extended 25%	48	48	48
12	Blue lead extended 50%	Blue lead extended 50%	Blue lead extended 50%	48	48	48
13	Red lead straight	Lamp black straight	Lamp black straight	48	48	48
14	Red lead straight	Lamp black extended 25%	Lamp black extended 25%	48	48	48
15	Red lead straight	Lamp black extended 50%	Lamp black extended 50%	48	48	48
16	Red lead extended 25%	Lamp black straight	Lamp black straight	48	48	48
17	Red lead extended 25%	Lamp black extended 25%	Lamp black extended 25%	48	48	48
18	Red lead extended 25%	Lamp black extended 50%	Lamp black extended 50%	48	48	48
19	Red lead extended 50%	Lamp black straight	Lamp black straight	48	48	48
20	Red lead extended 50%	Lamp black extended 25%	Lamp black extended 25%	48	48	48
21	Red lead extended 50%	Lamp black extended 50%	Lamp black extended 50%	48	48	48
22	Red lead straight	Iron oxide straight	Iron oxide straight	48	48	48
23	Red lead straight	Iron oxide extended 25%	Iron oxide extended 25%	48	48	48
24	Red lead straight	Iron oxide extended 50%	Iron oxide extended 50%	48	48	48
25	Red lead extended 25%	Iron oxide straight	Iron oxide straight	48	48	48
26	Red lead extended 25%	Iron oxide extended 25%	Iron oxide extended 25%	48	48	48
27	Red lead extended 25%	Iron oxide extended 50%	Iron oxide extended 50%	48	48	48
30	Red lead extended 50%	Iron oxide straight	Iron oxide straight	48	48	48
31	Red lead extended 50%	Iron oxide extended 25%	Iron oxide extended 25%	48	48	48
32	Red lead extended 50%	Iron oxide extended 50%	Iron oxide extended 50%	48	48	48
33	Iron oxide straight	Lamp black straight	Lamp black straight	48	72	72
34	Iron oxide straight	Lamp black extended 25%	Lamp black extended 25%	48	48	48
35	Iron oxide straight	Lamp black extended 50%	Lamp black extended 50%	48	48	48
36	Red lead straight	60% Red lead 20% Lamp bl. 20% Extended	50% Lamp bl. 50% Extended	48	48	48
37	Red lead straight	50% Lamp bl. 50% Extended	50% Lamp bl. 50% Extended	48	5	5
		Ground in raw linseed oil to paste reduced with fair grade paint oil proportion, 1 volume paste, 1½ vol. oil.	Ground in raw linseed oil to paste reduced with fair grade paint oil proportion, 1 volume paste, 1½ vol. oil.			
38	Three coats: ⅓ Basic lead chromate. ⅓ Lead Sulphate. ⅓ Lead chromate.	Ground in raw linseed oil reduced with boiled linseed oil.	Ground in raw linseed oil reduced with boiled linseed oil.	24	24	24

Panels exposed Nov. 24, 1924.

Undercoatings for pyroxalin lacquer finish

Your committee, to which was referred the question of pyroxalin lacquer under-coatings, reports that search was made of all available sources for information as to the possibility of getting a lacquer system of primers and surfaces as under coatings, either for pyroxalin lacquer finishes, or the long oil enamel, or a varnish system for finishing railroad equipment. The information received from the original producers of the pyroxalin system was discouraging. But it was recognized that if there was any merit in the lacquer method, the greatest saving of time required to finish a job could be made in extending the method to the under-coats. We made further inquiries and learned that one paint manufacturing firm was specializing on lacquered surfacers. We have tested its method on a number of cars with the following results as to time:

First day—Prime putty and knife-in where needed. If the car has been knifed-in all over, only one coat of surfacer is required which should be applied on the second day.
Second day—If the liquid surfacer is required to fill up a smooth surface, two or more coats should be applied.
Third day—Rub with wet or dry sandpaper.
Fourth day—Apply one coat of enamel body color.
Fifth day—Letter with gold leaf.
Sixth day—Apply first coat of wearing body varnish.
Eighth day—Apply second coat of wearing body varnish.
Tenth day—Car placed in service.

This method saves at least four days' time and gives the same general appearance that first-class railroads have heretofore obtained with the old time surfacer system and varnish methods.

If the pyroxalin lacquer finish was applied over the above surfacer system, it would mean that on the fourth day we would apply three coats of lacquer; on the fifth day we would apply gold leaf letters and figures; sixth day, pencil varnish over letters and figures; eighth day, apply second coat of varnish over letters and figures, the car being placed in service on the tenth day.

You will note that the lacquer finish does not save any time as compared to the varnish finish but is handicapped by the fact that it is practically an impossibility to apply sufficient varnish with a pencil to properly protect the gold leaf letters and figures. If a car is lettered and numbered with enamel colors, the car can be finished on the sixth day and placed in service on the eighth day. The method recommended by most of the firms who advocate pyroxalin lacquer finishes is to bring a car up as follows:

First day—Prime.
Third day—Apply body coat.
Fourth day—Putty and knife-in.
Fifth day—Apply surfacer coat.
Sixth day—Rub with wet or dry sandpaper.
Seventh day—Apply three coats of pyroxalin lacquer.
Eighth day—Letter and number with gold leaf.
Ninth day—Varnish over letters and figures.
Eleventh day—Varnish over letters and figures.
Thirteenth day—Car placed in service.

This saves one day's time over our present methods but does not give equal protection to the gold leaf letters. Therefore, the only object any one can have in using this method is the claim that the lacquer finish is practically indestructible and is more easily cleaned. These two claims are yet to be verified by actual experience. On the other hand, the pyroxalin under-coats not only save time in shopping but a smooth surface is obtained with less labor. The durability of this method, however, is questioned by many who have experimented in its manufacture. There are cars that have been in service for eleven months on which this primer and surfacer have been applied that show no deterioration.

If the claim made in regard to durability and ease with which the lacquer finish can be cleaned is substantiated by experience, your committee would suggest that it might be a satisfactory finish where enamel lettering colors are used.

Your committee having read the warning sent out by the insurance underwriters in regard to the use of these lacquers wishes to state that while we believe their warning is overdrawn and that they are making demands not in accordance with past practices in handling materials that are in our opinion more inflammable than the pyroxalin lacquers, we do endorse their recommendation that a segregated portion of the shop be equipped with an efficient ventilating system for the application of pyroxalin lacquers.

What paints are the most effective and cheapest for the preservation of metal surfaces?

The question of protecting steel cars from corrosion is becoming more important every day. This is due to a realization of the necessity of conserving our natural resources and reducing the expense of corroding steel cars and structures of various kinds that have to be replaced.

The only way of preventing steel from going back to its original state, is to protect the steel by an efficient film of paint to prevent the access of oxygen, sulphur, other gases and water to the surface of the steel. The paint film should, as far as possible, be a non-conductor to prevent any electrical action. After rusting has started it is difficult to stop. This action, while retarded, is not completely checked by painting over the rusted parts.

There have always been many opinions as to the best paints to use for the preservation of metal surfaces and the effect of using inert materials, such as asbestine, calcium carbonate, china clay, etc., which have a tendency to cheapen the paint mixtures. Some say they destroy their efficiency and others say they reinforce and make them more efficient. A number of paints were made up in Roanoke, Va., shops of the Norfolk & Western and applied to a series of 36 steel panels 10 in. by 16 in. by 1/16 in.

It was decided to use for the test the following pigments: basic lead chromate, sometimes called American vermilion; red lead, lamp black, metallic brown or iron oxide and blue lead. It was decided to use an inert extender in different proportions to cheapen the cost of the paint mixtures and to determine what quantities of extender might be used without reducing the efficiency of the paint. The idea was to select an extender that would answer for all mixtures. On account of its general characteristics and structure or form, asbestine was selected as the most suitable material for the purpose.

Boiled linseed oil was used as the vehicle for all mixtures except the red lead mixtures and one panel painted over red lead with a paint made up with a fair grade of paint reducing oil. All mixtures were ground reasonably fine except the red lead. In every case the red lead was mixed according to the Norfolk & Western standard formula; i.e., 20 lb. of dry red lead mixed in two quarts raw linseed oil to a paste, allowed to stand over night, thinned for use with one pint of raw linseed oil and one pint of turpentine. This mixture weighs exactly 26 lb. to the gallon and should be freshly mixed every 48 hrs.

A description or chemical analysis of the material used is shown as follows:

Red lead	True red lead (Pb_3O_4)	91.82
	Lead oxide	8.90
	Undetermined	.18
Boiled oil	Specific Gravity	.934
	Flash	545°F
	Iodine number	180
	Color O. K.	
	Odor O. K.	
	Manganese present.	

Turpentine—Pure.
Lamp black—Good quality, approximately 97 per cent carbon.
Blue lead—Lead sulphate one of the standard brands.
Oxide of iron—Sesqui oxide of iron 48.25 per cent, remainder siliceous material.
Basic lead chromate—Is a composition of approximately 33⅓ per cent each. basic lead chromate, lead sulphate and lead carbonate.

No dryer was used in any case. All proportions of the extender were calculated by volume. All panels were sand-blasted and received three coats.

The cost of these paints varied from approximately $0.80 to $3.50 a gallon.

The table shows what paint was applied to each panel and also the drying time allowed. The panels were exposed on the roof of the paint stock house with a southern exposure for about 10 months and, as we expected, they do not as yet show any marked developments. This test is now being extended to include the straight basic lead chromate, basic lead chromate with different proportions of iron oxide, different proportions of silica, also asphalts, oilsonites, ets., over rusted surfaces.

The report was signed by the chairman, James Gratton, general foreman painter, B. R. & P.; John McDowell, foreman painter, C. R. I. & P.; J. W. Gibbons, general master painter, A. T. & S. F.; B. E. Miller, master painter, D. L. & W.; Marceau Thierry, foreman, paint shop, N. & W.; L. B. Jensen, general foreman, passenger department, C. M. & St. P.; Thos. M. Davies, foreman painter, S. P.; F. B. Davenport, foreman painter, Penna.

IN RESPONSE to a letter from W. J. Harahan, chairman of the railroads' train control committee, urging a postponement of the effective date of the second train control order requiring the installation on the second division of the original 45 roads, the Interstate Commerce Commission has declined to entertain a blanket petition; but this does not prevent the filing of petitions by individual roads.

Decisions of the Arbitration Committee

(The Arbitration Committee of the A.R.A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Proper charge for replacing second-hand cast steel wheels with new cast iron wheels

On August 22, 1922, Louisville & Nashville box car No. 16859 was repaired, a change of wheels being made on account of a cut journal. One pair of second-hand Davis cast steel wheels mounted on a second-hand A.R.A. standard axle were removed and replaced with new cast iron wheels mounted on a new A.R.A. standard axle. The charges, amounting to $182.61, representing the difference in value of the axle and wheels removed and those replaced, were assessed against the car owner by the Charleston & Western Carolina, the repairing line. The C. & W. C. contended that the charges and credit for this repair were made in conformity with Supplement No. 1, Items 192, 193 and 197, Rule 101. The repairing line assumed responsibility for the cut journal and restored the car to its original condition and then gave the car owner credit for the scrap axle at second-hand value. It therefore contended that the additional expense due to the application of new wheels and a new axle should be borne by the car owner as the repair constituted a betterment to the car. The L. & N. contended in its statement that the charge for the new wheels and axle applied should not have exceeded that of second-hand material as this repair work was nothing more than an ordinary case of wheels changed on account of a handling line defect.

In rendering its decision the Arbitration Committee sustained the contention of the L. & N. and stated that the principle of interpretation No. 5 to Rule 98 (1921 Code) applies.—*Case No.* 1337, *Charleston & Western Carolina vs. Louisville & Nashville.*

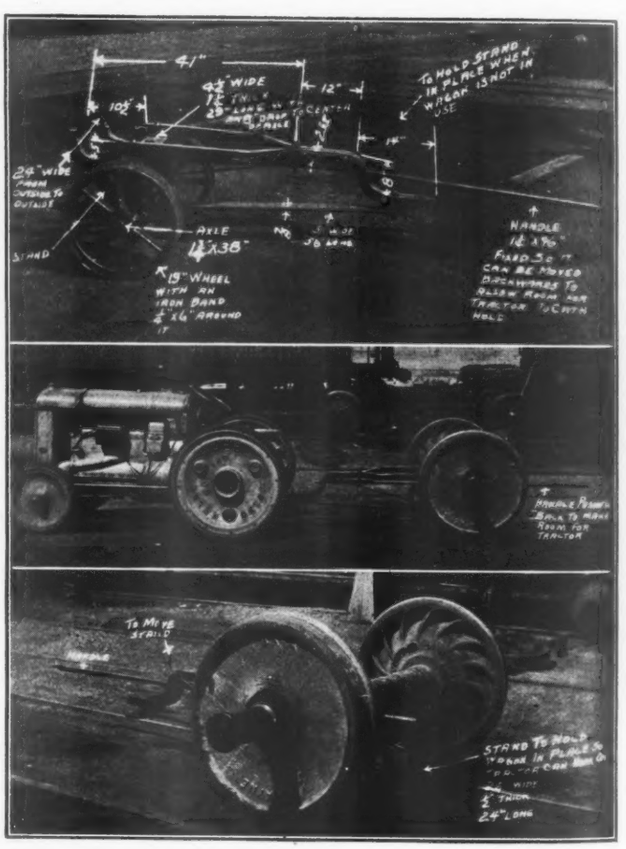
Another case under Rule 32

Chicago & Northwestern stock cars Nos. 17153 and 17347 failed while being handled by the Baltimore & Ohio. Car No. 17153 was broken in two, one end dropping on the rails. Both cars were practically destroyed. The B. & O. reported the cars under Rule 112, claiming that the damage to the cars was the owners' responsibility. The car owner objected to this, stating that when the handling line wrecking foreman arrived at the point of the accident, he found that car No. 17153 was broken in two with one end on the ground and the truck shoved back towards the opposite end of the car. This condition constitutes unfair usage within the intent of Rule 32, and places the responsibility for the damage to both cars with the handling line. The handling line stated that the cars were handled in a train of 38 loads and 55 empties. The train was moving at six miles per hour and approaching a crossing when the engineman discovered a signal against his movement and made a service reduction of 10 lb. which caused the slack to run in and buckle the two cars in question. The cars were not cornered, sideswiped, derailed, or in any other way damaged, which under Rule 32, would make the handling line responsible. The B. & O. further contended that all the damage was sustained before the end of the car dropped on the rail.

In rendering its decision the Arbitration Committee stated that the handling line is responsible. Arbitration decisions 1186 and 1236 apply.—*Case No.* 1342, *Chicago & Northwestern vs. Baltimore & Ohio.*

Transporting wheels with a Fordson tractor

THE delivery of wheels in a car yard can be done more efficiently with proper and adequate equipment than when performed by manual labor. Previous to the installation of the equipment shown in the illustration, wheels were handled at the Curtis Bay, Md., car shops of the Baltimore & Ohio, from the supply track to the car by four men. A short time ago a Fordson tractor was added to the equipment at these shops and in order to speed up the delivery of wheels as well as to perform this work more economically, two car repairmen and an apprentice built the wagon shown in the top view



Tractor wheel trailer built for making deliveries from the supply track to the car

of the illustration. We are indebted to W. W. Calder, district master car builder, Baltimore & Ohio, and to the Baltimore & Ohio magazine for the photographs and description of this wagon.

The wagon consists essentially of two cast iron wheels and a chassis on which provision has been made for carrying the wheels on one end while the other end couples directly to the tractor. The important dimensions and details of construction are shown in the top view of the illustration. The wagon is also provided with a handle so that it can be pulled by two men. This handle can be moved back out of the way when the wagon is coupled to the tractor.

Southern increases its car repair facilities

New shop at Hayne, S. C., has monthly output of about 80 passenger and 500 freight cars

By A. B. Brown
Westinghouse Electric & Manufacturing Company

THE Southern Railway, in carrying forward an extensive improvement program, has increased its car repair facilities by the addition of a new shop at Hayne, located near Spartanburg, S. C. This shop was placed in operation, January 2, 1925, and is equipped to handle repairs for both passenger and freight cars. Since that time, it has taken over the work which was formerly handled at Columbia, S. C., and now has facilities for performing general repairs to about 80 passenger cars and to rebuild 500 freight different type cars per month.

Referring to the layout drawing of the car repair tracks and buildings, it will be noted that the shop is laid out to handle repairs by the straight line system. Cars to be repaired are switched into the repair yard, past the reclamation shop building and scrap dock, and are classified both as to class of repairs and type of car. This system simplifies the actual production work to a great extent when the cars are started through the shop.

The freight car department

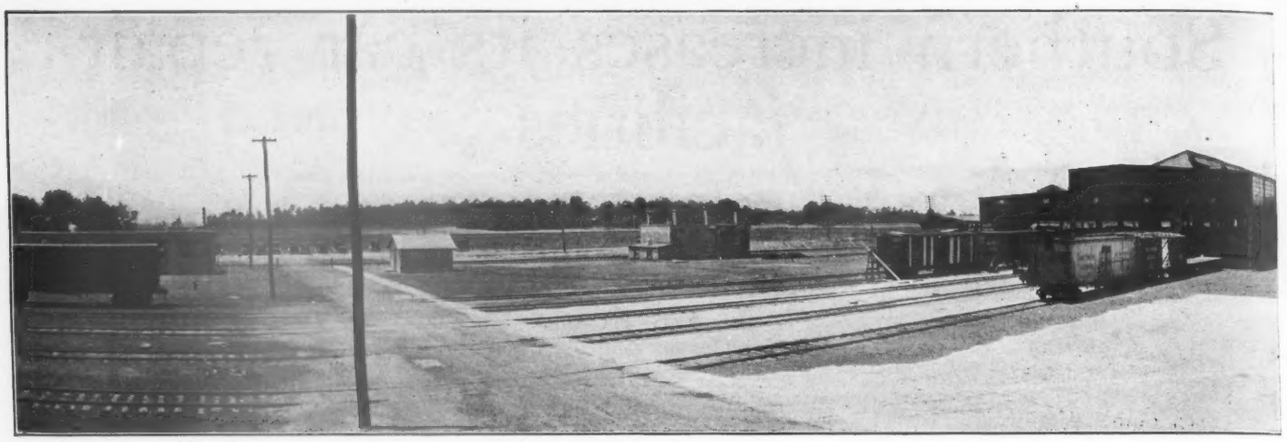
The freight car shop, 391 ft. long by 107 ft. wide, is of structural and corrugated steel open construction, affording a maximum amount of light and ventilation. It contains five tracks and has capacity for 40 cars. Heavy steel cars are repaired on track No. 1 which is located adjacent to the fabrication shop bay and is served by a 15-ton electric crane. Tracks No. 2 and No. 3 are also served by an electric crane and are used for stripping heavy and medium repair cars, respectively. The straight-line system is also used for light repair work which is done on track No. 4 while track No. 5 is used for finishing up. Permanent scaffolding is provided for the last two tracks.

The yards and tracks are so constructed that the cars move on one continuous track practically by gravity from the storage yard through the freight car building to the paint yards. When the cars are placed in the storage yard they are checked up and listed showing the amount of work necessary in order that the material can be gotten out through the different departments, blacksmith and planing mill, in advance of the time the cars are placed for the car repairs. From six to eight days is the average time required for repairing a car; which usually includes one day on the stripping track; three to four days repairing, and two to three days on the paint tracks.

Interior view of the planing mill showing the arrangement of machinery on one side of the mill and the sawdust conveyor system

The planing mill is well equipped

The planing mill is located in a separate building, 100 ft. wide by 162 ft. long and is situated convenient to the freight car repair shop, lumber storage yard and dry kiln, thus effecting minimum hauls to the various points. The building is airy, light and modern in every detail of de-

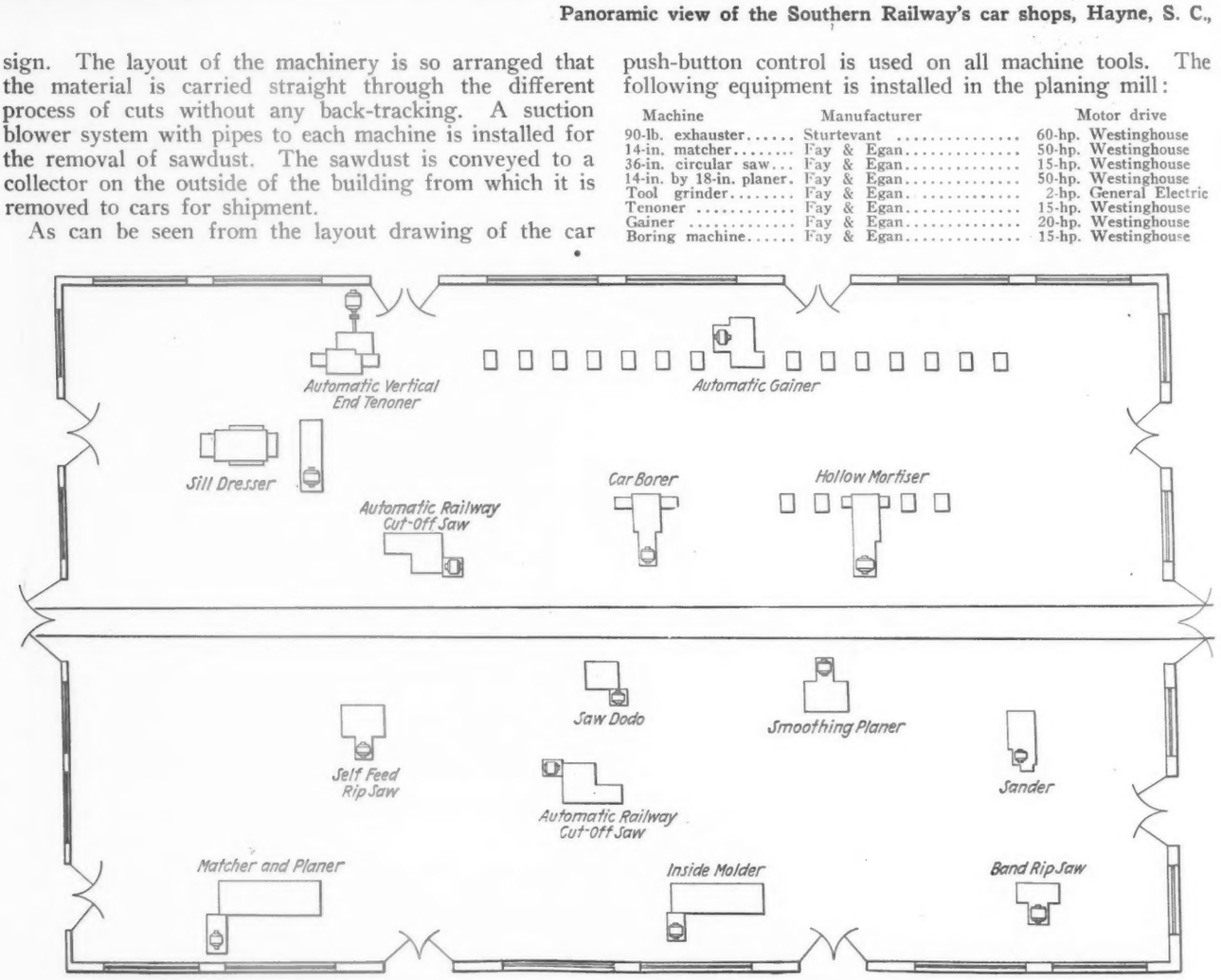


Panoramic view of the Southern Railway's car shops, Hayne, S. C.,

sign. The layout of the machinery is so arranged that the material is carried straight through the different process of cuts without any back-tracking. A suction blower system with pipes to each machine is installed for the removal of sawdust. The sawdust is conveyed to a collector on the outside of the building from which it is removed to cars for shipment.

As can be seen from the layout drawing of the car repair tracks and buildings, there is one supply track running into the planing mill from the lumber yard. The shops are served from here by trucks and tractors as shown in one of the illustrations. After the lumber is machined, it is either taken direct to the car or stored for use when needed. All freight car doors are made in the planing mill and completed with hangers and trimmings ready to be applied to the cars. A steel-top table is located in one corner of the mill where the side doors are assembled. Individual motor drive with automatic push-button control is used on all machine tools. The following equipment is installed in the planing mill:

Machine	Manufacturer	Motor drive
90-lb. exhauster	Sturtevant	60-hp. Westinghouse
14-in. matcher	Fay & Egan	50-hp. Westinghouse
36-in. circular saw	Fay & Egan	15-hp. Westinghouse
14-in. by 18-in. planer	Fay & Egan	50-hp. Westinghouse
Tool grinder	Fay & Egan	2-hp. General Electric
Tenoner	Fay & Egan	15-hp. Westinghouse
Gainer	Fay & Egan	20-hp. Westinghouse
Boring machine	Fay & Egan	15-hp. Westinghouse

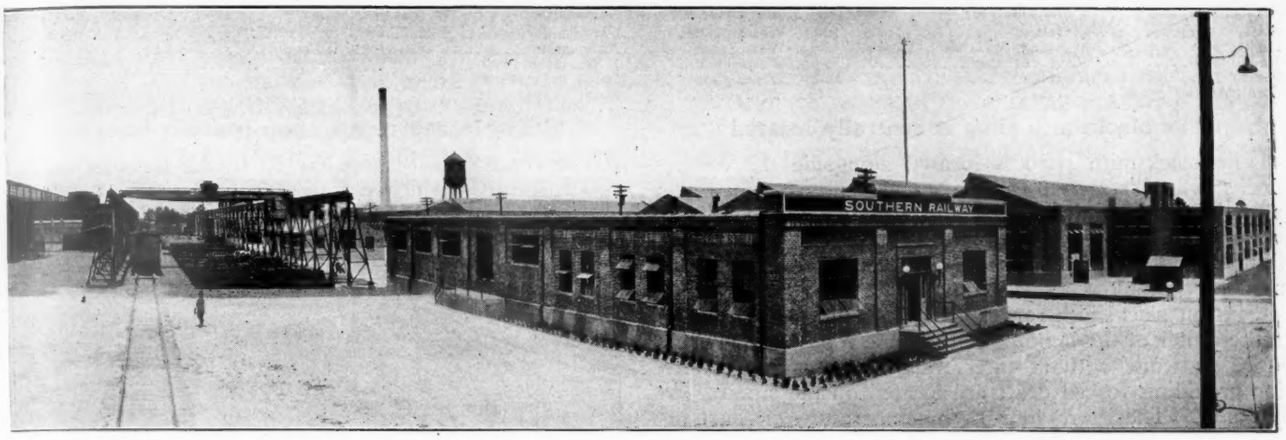


Drawing showing the arrangement of machine tools in the planing mill

Mortiser	Fay & Egan	20-hp. Westinghouse
13-in. circular saw	Fay & Egan	5-hp. Westinghouse
36-in. cut-off saw	Fay & Egan	20-hp. Westinghouse
36-in. cut-off saw	Fay & Egan	20-hp. Westinghouse
Machine moulder	Newman	40-hp. Westinghouse
Band saw	Fay & Egan	10-hp. Westinghouse
Sander	Fay & Egan	15-hp. Westinghouse
Tenon machine	Greenlee	15-hp. Westinghouse

Kiln for drying lumber

One of the features of the equipment at the Hayne shop is the dry kiln, manufactured by the National Dry Kiln Company, Indianapolis, Ind., for drying lumber used



showing the freight car shop in the center

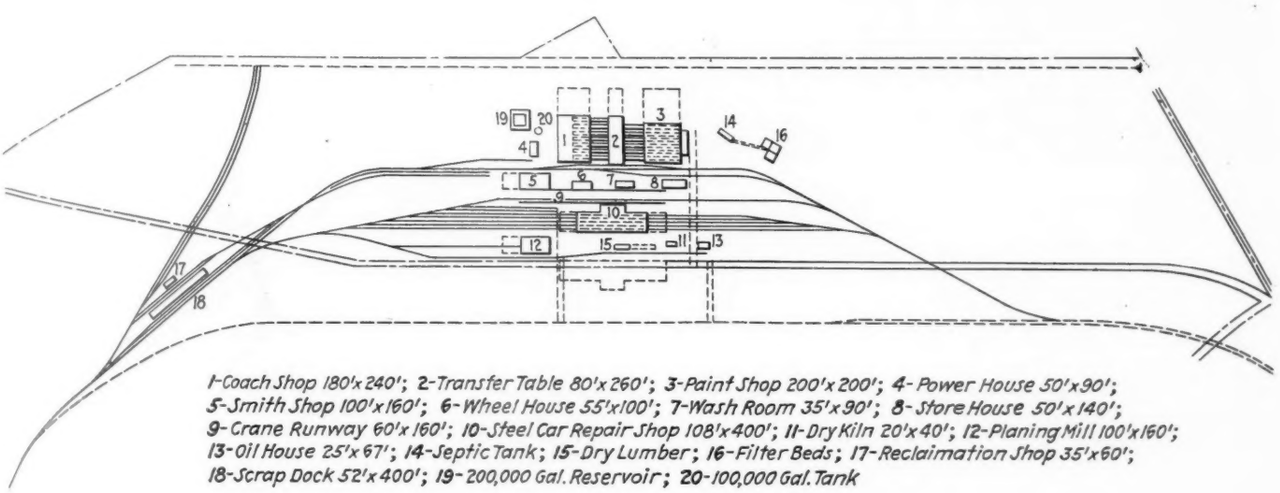
in the repair of passenger coaches and refrigerator cars. The dry kiln is a concrete and brick structure, 40 ft. long by 20 ft. wide with two sliding doors at the front. The kiln contains two tracks where small cars loaded with lumber are placed during the drying period. The drying is accomplished by heat from a double layer of steam pipes under each track. A 3-in. water spray pipe with small holes drilled in each side is located just above the steam pipe.

The lumber is systematically loaded on the cars to allow a maximum amount of air circulation. Careful tests are made and records are kept both before and during the drying period from sample pieces which are chosen from different sections of the pile. A piece is cut off one foot from the end and then the sample piece is cut off for testing on a special scalometer or Evapercenter. From four to six samples of board are tested, tests being made at intervals of from 24 to 48 hrs. The fresh ends of the sample boards are then painted with graphite paint mixed with rosin to prevent drying out at the end. When the final tests have indicated that the moisture content of the stock is down to the desired point, the Moistat is shut off, the heat cut off, and the ventilation closed. The stock is then left from 12 to 24 hrs. with the Moistat and ventilation shut off.

The Moistat is a self-contained thermostatic device for regulating the temperature of the kiln. Its power is obtained from expansive volatile liquids which are sealed in the instrument. These liquids expand and generate pressure in exact proportion to the temperature surrounding the thermostat.

The lumber is allowed to dry itself as long as it gives up its moisture readily. After a time steam is required. The instrument is sensitive to this need through the thermostat, allowing steam to pour into the kiln. This continues until the wet bulb temperature is raised sufficiently to generate a pressure which will be ample to tightly close the valves.

The operating room where tests and records are made adjoins the dry kiln in the rear. Here, is also placed the Moistat regulating device for regulating the temperature of the kiln.



1-Coach Shop 180'x240'; 2-Transfer Table 80'x260'; 3-Paint Shop 200'x200'; 4-Power House 50'x90'; 5-Smith Shop 100'x160'; 6-Wheel House 55'x100'; 7-Wash Room 35'x90'; 8-Store House 50'x140'; 9-Crane Runway 60'x160'; 10-Steel Car Repair Shop 108'x400'; 11-Dry Kiln 20'x40'; 12-Planing Mill 100'x160'; 13-Oil House 25'x67'; 14-Septic Tank; 15-Dry Lumber; 16-Filter Beds; 17-Reclaimation Shop 35'x60'; 18-Scrap Dock 52'x400'; 19-200,000 Gal. Reservoir; 20-100,000 Gal. Tank

Layout of the car repair tracks and buildings

The fabrication shop

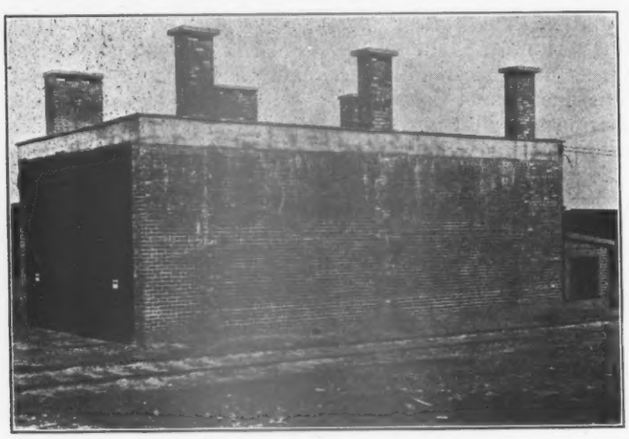
The fabrication shop for working and assemblying metal material used in the repair of steel cars and heavy repairs of wooden cars is built as an annex to the freight car shop proper. The shop is 51 ft. wide by 115 ft. long with one side opening into the freight car shop adjacent to tracks No. 1 and No. 2 where the heavy repairs are made. Both the blacksmith shop and casting docks are situated near the fabrication shop so that the production on metal work may not be delayed by long haulage. The fabrication shop contains the following equipment:

Machine	Manufacturer	Motor Drive
Shear	Cleveland	10-hp. Westinghouse
Drill press	Manning, Maxwell & Moore	3-hp. Westinghouse
Radial drill	Reed Prentice	5-hp. Westinghouse
Punch	Cleveland	10-hp. Westinghouse
Straightening press		

The blacksmith shop is centrally located

The blacksmith shop is located alongside the casting docks where material can be conveniently reached and stored. The building, which is 100 ft. long by 60 ft. wide, is a fire-proof structure of modern design, well lighted and ventilated. It is completely equipped with modern equipment.

Sixteen blacksmith forges are arranged in double rows in the center of the building with ample room around each forge to work without interference. Pressure blowers for providing forced draft are located on the side of the building. There are four high temperature oil burning furnaces placed at convenient points throughout the shop. Oil is pumped from an underground tank to the furnaces by a steam driven oil pump. Exhausts through the roof are provided for the 1500-lb. and 3400-lb. steam hammers. The blacksmith shop was planned with ample capacity to



Kiln for drying lumber to be used in the repair of passenger and refrigerator cars

take care of any future additions that might be made to the car repair shop. The equipment consists in part of:

Machine	Manufacturer	Motor Drive
Turbo considal	Buffalo	7½-hp. Westinghouse
Type R pressure blower	Buffalo	20-hp. Westinghouse
Hammer	Bradley	10-hp. General Electric
Bulldozer	Williams & White	20-hp. Lincoln
Bolt header	Williams & White	16-hp. General Electric
Punch and shear	New Doty	15-hp. Triumph
200 ampere arc welding set	Westinghouse	

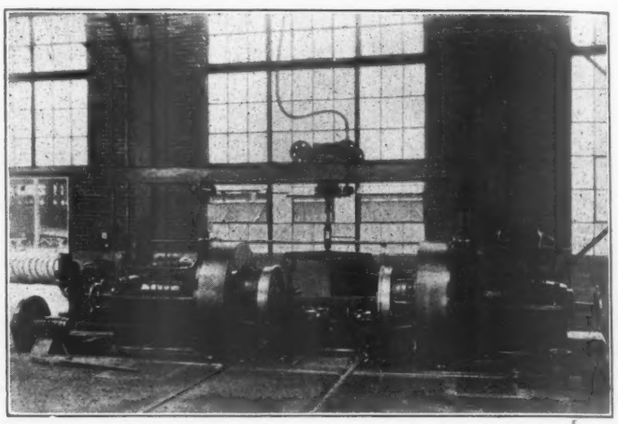
Wheel shop serves for both freight and passenger car repairs

The wheel shop which serves both the freight car and coach repair shop is situated between the two and is readily accessible to both of these departments. There is sufficient storage space for mounted and unmounted wheels and axles. An electric traveling crane serves the storage platform. Like the blacksmith shop, the wheel house was designed to take care of future production far exceeding the present output. The building is 102 ft. long by 55 ft. wide and is of the same general construction as the blacksmith shop and planing mill. Space has been provided for the future installation of an additional axle lathe and boring mill. The equipment includes the following:

Machine	Manufacturer	Motor Drive
Car wheel lathe	Niles-Bement-Pond	50-hp. Westinghouse
Car wheel lathe	Niles-Bement-Pond	10-hp. Westinghouse
400-ton wheel press	Chambersburg	10-hp. Westinghouse
Car wheel borer	Putnam	15-hp. Westinghouse
Axle lathe	Niles-Bement-Pond	15-hp. Westinghouse
18-in. lathe		Westinghouse
26-in. drill press		Westinghouse
32-in. shaper		Westinghouse

The coach repair shop has ten tracks

The coach repair shop has 10 tracks for coaches and two for trucks which occupy about one-half of a building, 180 ft. wide by 24 ft. long. The roof is of the saw-tooth design, with skylights on one side of each tooth



Niles-Bement-Pond car wheel lathe installed in the wheel shop

which affords good light and ventilation. Permanent scaffolding is suspended from each column between the tracks. The cross arms of the scaffolds are counterbalanced by weights, enclosed in a casing which protects them from outside interference. Seventeen holes are drilled in the uprights affording adjustments for any desired height of scaffolding.

All passenger cars are brought into the yard and

Coach machine shop—The pipe, tin and cabinet shops are located in the rear

placed on the stripping tracks. At the present time the stripping is done in one side of the paint shop because of the nearness of this location to the different departments for cleaning and painting the coach accessories. The upholster work is taken to the upholster shop and the trimmings to the wash rack. The trimmings are afterwards moved to the paint shop and prepared for reapplication to the car.

After the car is stripped it is moved to the outside of the building on a length of track between the transfer

table and paint shop, where the trucks are removed from one end and emergency trucks are substituted. The car is then taken over the transfer table to the opposite side of the tracks where the remaining trucks are removed and emergency trucks are installed. The trucks are then taken to the truck shop for overhauling, and the car to the coach shop for necessary repairs. When the work has been completed on the coaches they are placed back in the paint shop for painting and re-applying the upholstering and trimmings.

The coach machine shop and cabinet shop are located in the same building

The coach machine shop, cabinet shop, tin and pipe shops are located in the coach repair building. This location is advantageous because of its accessibility to the repair tracks. Modern metal and woodworking machinery are used throughout, all of which are equipped with individual electric drive and push-button control. The following is a list of tools in the cabinet shop:

Machine	Manufacturer	Motor drive
Shaper	Fay & Egan	5-hp. Westinghouse
Cabinet planer	Fay & Egan	15-hp. Westinghouse
Band saw	Fay & Egan	5-hp. Westinghouse
Universal worker	Fay & Egan	5-hp. Westinghouse
Universal cabinet saw	Fay & Egan	5-hp. Louis Allis
Molder	Fay & Egan	10-hp. Westinghouse
Mortiser	Wysong & Miller	1½-hp. General Electric
Drill press	Manning, Maxwell & Moore	2-hp. Westinghouse

The machine shop contains the following machine tools:

Machine	Manufacturer	Motor drive
Drill press	Manning, Maxwell & Moore	2-hp. Westinghouse
Shear	Williams & White	10-hp. Westinghouse
Radial drill	Niles-Bement-Pond	10-hp. Westinghouse
Bolt cutter	Acme	5-hp. Westinghouse
Radial drill	Reed Prentice	5-hp. Westinghouse
Angle bender	Ryerson	15-hp. General Electric
Punch and shear	Buffalo	

The paint shop

The repaired cars are taken first to an outside track where they are thoroughly cleaned by air and are then taken into the paint shop to be scrubbed. The paint shop has capacity for 20 cars, two cars to a track. Permanent scaffolding, similar to that in coach shop, is provided. The building is heated by steam in cold weather, a constant temperature of 70 deg. being maintained.

In cases where the surface of the wooden coaches is practically gone, the paint is burned off with a kerosene torch. At the present time, paint is removed from steel cars with a paint remover, but it is planned to use sand blast for this work as soon as the apparatus is installed.

Where the surface is in fairly good condition, a primer is put on and allowed to dry for 48 hours. Then coats of No. 2 and No. 3 paint and a surfacing composition are used, in the order named, with intervals of one day between each application. The car is next rubbed to a surface and two coats of body color and two coats of varnish are applied.

If the surface is in good condition, the raw spots are sanded and touched up with a primer. They are then puttied and sanded, after which color and varnish are applied. The trucks and underframes are sprayed after the painting on the coaches has been completed.

A feature of the coach shop layout is the electrically driven transfer table. The table, which is 80 ft. long, is of sufficient length to accommodate the largest coaches. Cars are pulled on and off the table by means of a cable from a drum geared to the main motor. A clutch is provided for disengaging the motor pinion from the main driving gears which transfers the motion to the cable drum. Reversing is obtained with drum control.

Interior view of the paint shop showing the type of scaffolding used in coach repair work

The air brake room

A partitioned space, 22 ft. by 52 ft., in one corner of the coach machine shop is set aside for the air brake room. The equipment includes a universal control rack, triple valve test rack with an auxiliary device and three benches, each 38 in. by 10 ft. A double rack for storing triple valves is placed just outside of the air brake room in the machine shop.

Repaired valves are placed in one section of the rack, while another section is reserved for valves to be repaired. A similar rack is located in the fabrication department of the freight car repair shop in order that the freight cars may be serviced with the least possible delay. This rack is replenished daily.

Department for electro-plating

An electro-plating room is situated in the paint shop building. All brass work such as locks, door hinges, baskets, sash locks and light fixtures are cleaned here. The fixtures are cleaned by boiling in a caustic soda solution. They are then run through an acid solution for brightening. All permanent brass fixtures are next buffed and lacquered, while those requiring an oxidized finish are oxidized with liver of sulpher, run over with a scratch wheel and lacquered.

Here all mirrors and dining car silver are reclaimed and plated. After the silver has been cleaned with Kostico and pumice, it is put in a silver "strike" tank, where a thin coat is applied. It is then dipped into the regular silver tank, taken out and scratched, put back in the silver tank, and finally polished on a wheel. The

same general process is followed for nickel, copper and tin plating with the exception that no "strike" tank is used. The equipment includes a Hanson and Van Winkle, six volt, 100 ampere electro-plating motor generator set and three buffing wheels.

The upholstering department

The upholstering department, where curtains, seats and backs are cleaned and repaired, is located on the second floor, above the plating rooms. The seats are cleaned by a vacuum process. They are then dipped in a cleaner solution and brushed on a high speed rotary brushing machine. Most of the moisture is eliminated by this process and they are drying within two hours.

A novel machine for brushing washed seats is used in this department. It is 4½ ft. long by 1 ft. 9 in. wide and 2 ft. high, having a framework of channel iron. A stiff bristle brush, 9 in. by 14 in. is coupled to a five-hp. motor which revolves at a speed of 1,160 r.p.m. Three two-inch wooden rollers are placed in the front and rear of the brush so the seats may be easily moved back and forth across the revolving brush. The average time for

Fordson tractors are used to handle material

washing the seats and backs of a day coach is 2½ hrs., which is 50 per cent less than the time required by ordinary processes.

Power is secured from the South Carolina Light and Power Company. Two circuits, each 33,000 volts, 3-phase, 60 cycles are available at the sub-station. In the event service is interrupted on one circuit, a change-over can be made to the other circuit, thus assuring continuous power service. The voltage is stepped down through three 500 KVA transformers to 440 volts which is used throughout the shop.

Two 500-hp. O'Brien boilers furnish steam for the dry kiln, steam hammers, heating system and steam-driven air compressor. The equipment also includes a 1,500-cu. ft. motor-driven air compressor. Ample fire protection is assured by a fire pump which delivers 1,000 gal. per min. The plant is provided with a 100,000-gal. tank and a 200,000-gal. reservoir.

Daily reports are sent to the superintendent's office by each department. In this way a close check is kept on the ratio of production throughout the shop and work can be assigned accordingly.

A foreman's meeting is held once a week. Suggestions regarding new equipment, welfare of the employees and any points which might be of material interest are discussed here. No doubt these meetings have played a prominent part in establishing and maintaining the close co-operation which is evident between the several departments. Much of the credit for the efficient operation of the shop can be attributed to J. O. Johnson, superintendent car shops, who directs its operation.

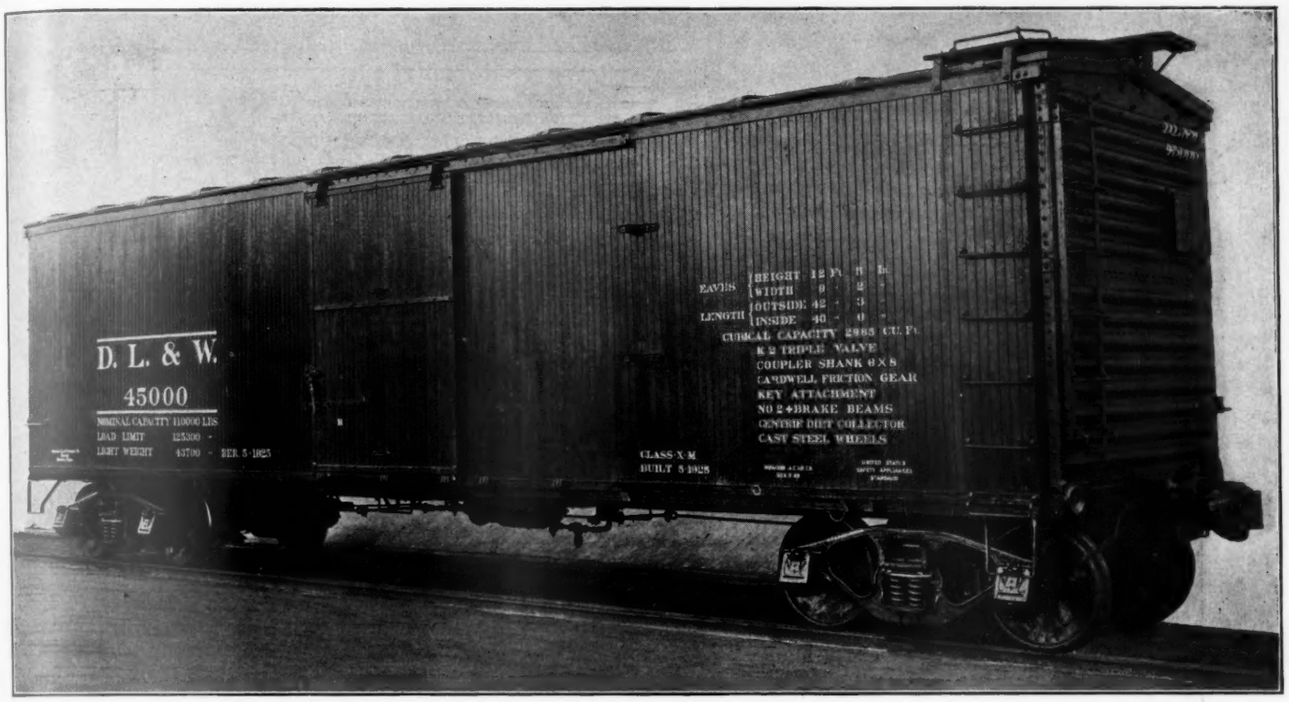
The Hayne car shop was designed and built under the supervision of H. W. Miller, vice-president, Southern Railway, and R. L. Ettenger, consulting mechanical engineer and assistant to Mr. Miller. Dwight P. Robinson Company were the contractors and constructing engineers.

Method of preventing ladders from over-balancing

IT is common practice to provide means to prevent a ladder from slipping on a greasy or otherwise slippery floor. The rail ends of the ladder shown in the illustration are provided with pointed iron grips which is one way of preventing slipping. There is, however, another danger to guard against when using a ladder. In car repair work a ladder is often placed against a scaffolding, as shown in the illustration, so that a portion of

Chain used to prevent a ladder from overbalancing when a workman is on the upper end

it overhangs. The workmen will use the ladder in this position to reach the roof of the car. If the ladder is not properly fastened, his weight on the upper end will cause it to overbalance and result in an accident. A simple but effective way to prevent such accidents is to fasten to the lower end of the ladder a chain, the other end of which is attached to a trestle under the car, as shown in the illustration, or it can be readily fastened to any part of the under construction of the car. The chain is permanently fastened to the ladder, thus preventing it from becoming lost and also eliminating the tendency of a workman of not securing the ladder owing to the fact that there is no chain handy for this purpose.



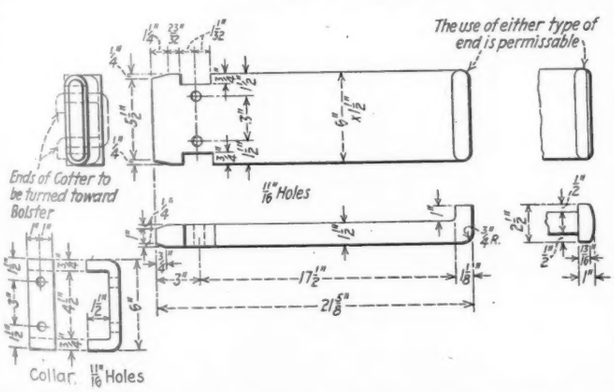
D. L. & W. 55-ton, 40-ft. 6-in., double sheathed box car built according to A. R. A. specifications.

Double sheathed 55-ton box cars for the D. L. & W.

Built according to A.R.A. specifications—Have a carrying capacity of 125,000 lb. and weigh 43,700 lb.

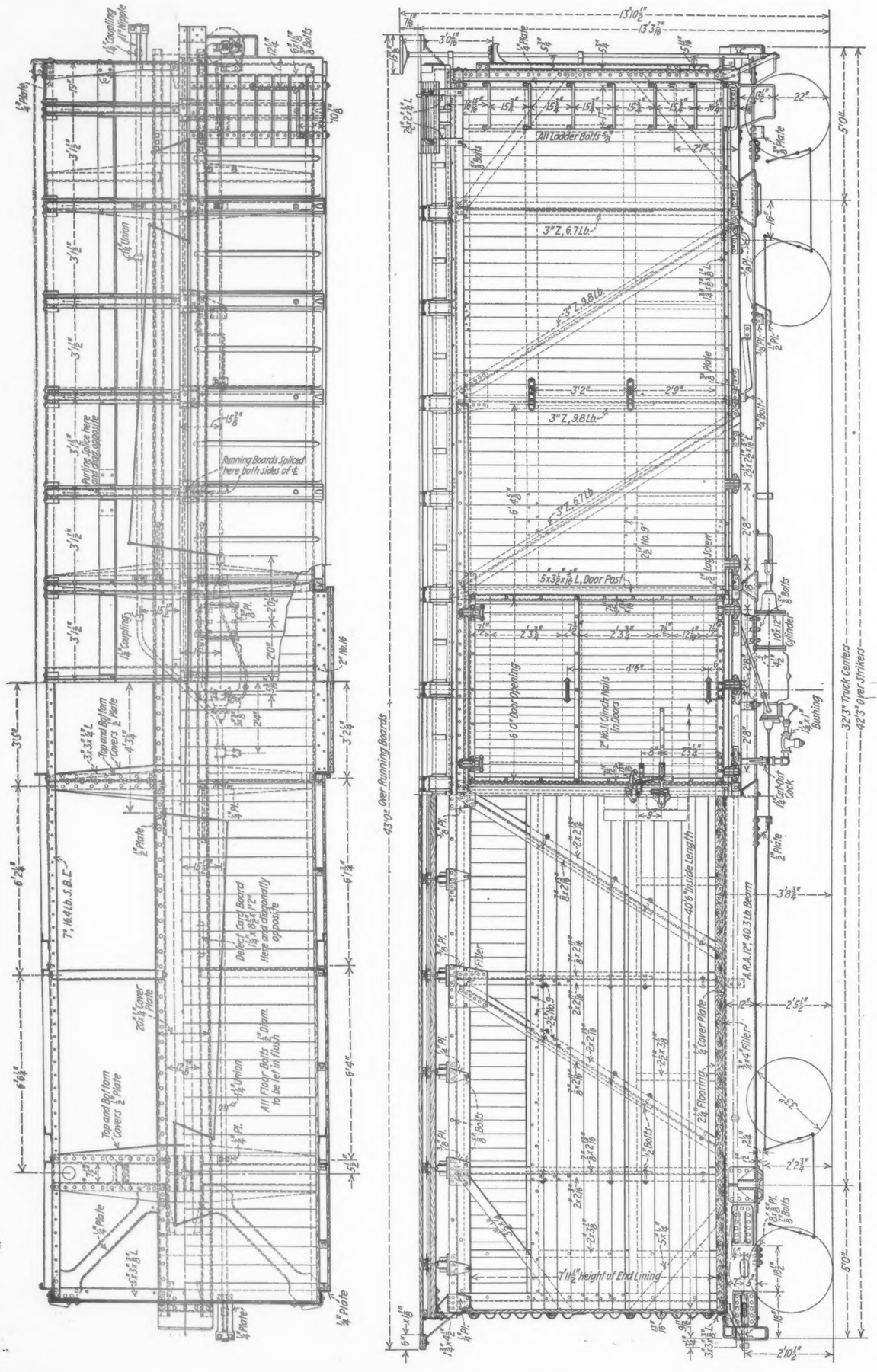
By P. Alquist
Master car builder, D. L. & W., Scranton, Pa.

THE terminal facilities of the railroads serving New York are steadily becoming inadequate to unload quickly the enormous number of cars which enter the metropolitan area every 24 hours. Enlargement of the terminals is restricted by the lack of sufficient ground for expansion. The Delaware, Lackawanna & Western is one of the railroads confronted with this problem at its eastern terminus.



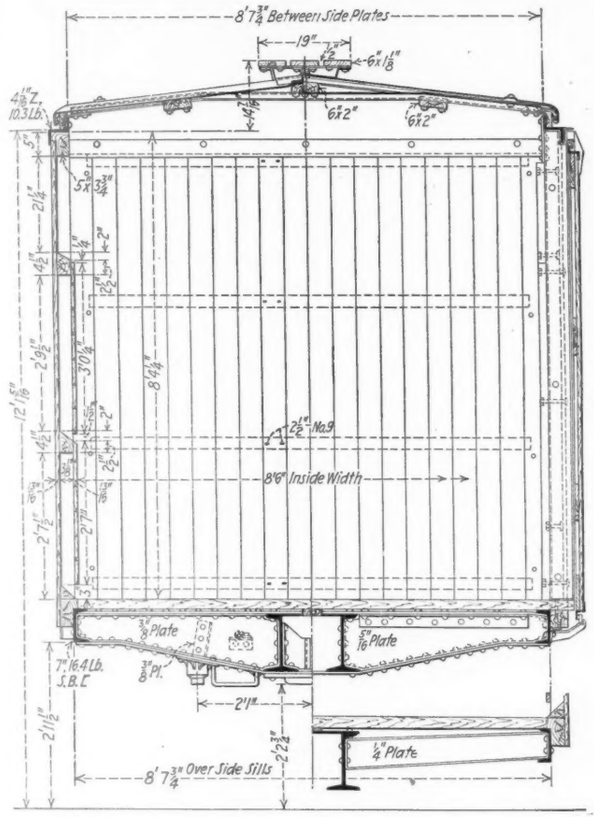
A method of fastening coupler yoke cross key cotters to prevent them from shearing off

One of the methods of combating this problem is to increase the capacity of the cars handling grain, flour, cement, coffee, sugar, etc., without greatly increasing the weight. This was accomplished in the 1,000, 55-ton, steel underframe, double sheathed box cars built by the American Car & Foundry Company, Berwick, Pa., according to A. R. A. specifications. The cars have been in service six months and have proved very satisfactory. These cars were obtained to replace 60,000-lb. capacity equipment retired on account of age, construction and light capacity. The cars dismantled weighed 38,000 lb. The new cars, which will carry 125,000 lb. of grain from the Great Lakes to tidewater, have double the capacity of the old cars, with an increase in weight of only 5,700 lb., or, by increasing the weight of a unit 15 per cent, the carrying capacity was increased 100 per cent. This advantage is particularly noticeable in the room occupied by the trains in the terminal. The capacity of each car unloaded on the grain dock is now equal to two of the older type and it can be unloaded in one-half the time formerly required to unload the same capacity. These cars weigh 1,800 lb. less than the U. S. R. A. 80,000-lb.


Running Boards Spliced here, both sides of ℄
Purline Splice here and diag. opposite
Top and Bottom Covers ½ Plate
Top and Bottom Covers ½ Plate
Defect Card Board ¼ x 10½ x 12" here and diagonally opposite
All Floor Bolts ⅝" Diam. to be let in flush
All Ladder Bolts ⅝"
3" Z, 6.7 Lb.
3" Z, 9.8 Lb.
5x3½x7/16 L. Door Post
6'0" Door Opening
2 No. 11 Clinch Nails in Doors
40'6" Inside Length
A.R.A. I.2, 40.3 Lb. Section
Height of End Lining
43'0" Over Running Boards
32'3" Truck Centers
42'3" Over Strikers

Plan and elevation view of the D. L. & W. double-sheathed 55-ton box car

capacity cars. The switching of our grain trains has been reduced one-half on account of the increased capacity per car. The royalty on patent grain doors and all labor in-



Cross section of D. L. & W. steel frame box car

cident to preparing cars at the loading and unloading points has reduced one-half. Only one-half the number

Murphy corrugated ends are used on these cars

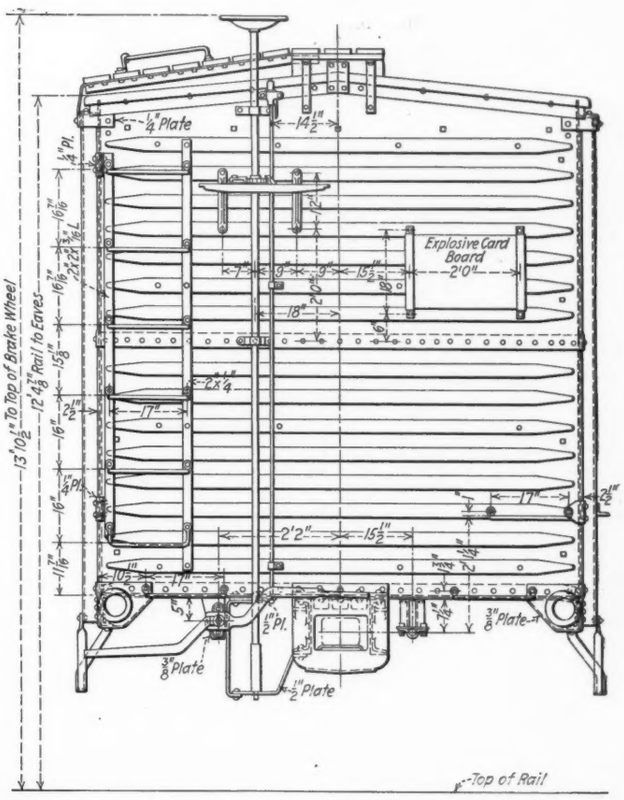
of grain doors have to be returned from tidewater to the Great Lakes in shipping any amount of grain.

General arrangement and details of construction

The underframes are of openhearth steel throughout The center sills consist of two 12-in. A. R. A. standard 40.3-lb. special rolled channels, reinforced by a ¼-in. by 20-in. top cover plate.

The body bolsters are of the built-up design consisting of two ⅜-in. diaphragms, extending from the center to the side sill channel and spread 7½ in. between the webs. They have a steel filler casting between the center sills. These are all connected together and reinforced by ½-in. top and bottom cover plates.

The side sills are of 7-in., 16.4-lb. channels and have angles riveted to the outside faces. The end sills are of 5-in. by 3-in. by ⅜-in. angles and are riveted to the



End view of the D. L. & W. box car showing arrangement of ladder, grab irons, etc.

side sills, diagonal braces and center sills. The body framing consists of 3-in. Z-posts and 3-in. Z-braces riveted to the top plate gusset and side sill.

The cars are equipped with Murphy corrugated steel ends which are made in two sections, the upper section being 3/16 in. and the lower ¼ in. thick, with substantial gussets extending back over the outside sheathing.

The siding is Douglas fir, 13/16-in. thick, dressed on both sides, tongued and grooved. The end and side lining is of the same material, also tongued and grooved, extending from the floor to the top of the car and all secured to 2½-in. by 2-in. fillers bolted to the corrugations of the steel ends. The 2¼-in. thick by 5¼-in. face yellow-pine flooring is tongued and grooved and extends to the outside edge of both end sills. Steel threshhold plates are applied in each door.

The Hutchins dry-lading roof made of No. 16 gage steel is used and is supported by pressed steel carlines.

The latitudinal running boards are of Douglas fir, dressed on one side to 1⅛ in. thick and applied rough side up. The longitudinal running boards are of three planks, 6 in. wide by 1⅛ in. thick, dressed on one side and applied rough side up. They are secured to pressed steel saddles by ⅜-in. carriage bolts.

Single side Camel No. 27 doors are used which provide an opening of 6-ft. They are steel bound, top hung, equipped with Camel combination door stop, lock and door closing and starting device.

The cars are equipped with 55-ton Bettendorf 5-ft. 6-in. wheel base trucks, with U-section cast steel frames. The journal boxes are an integral part of the truck frames, and conform to the A. R. A. standard dimensions for 5½-in. by 10-in. axles. The Barber lateral motion device and Woods tip roller side bearings are incorporated in the truck design. The truck bolsters are of the cast steel type. The ends of each bolster are provided with three rollers of cold rolled steel 2 in. in diameter and 10 in. long. The combination roller seats and spring caps are of drop forged steel. Davis cast steel wheels are used, which reduced the light weight 1,200 lb. per car.

The draft gear is the Cardwell type G-11-AA and the A. R. A. standard Type D coupler with a 6-in. by 8-in. shank is used. The couplers are equipped with 18½-in. pocket Universal cast steel yokes. The uncoupling device is the Carmer type. To prevent the coupler yoke cross key cotters from shearing off, which is so prevalent with the Type D key couplers, the D., L. & W. has designed and patented a key fastening, shown in one of the illustrations, which takes the strain off the cotter. It has four and one-half times greater shearing resistance than the ⅝-in. U bolt used on the A. R. A. cars. This fastening has eliminated cross keys from working out.

The air brake equipment is the Westinghouse quick-action, automatic Schedule K. C. 1012, with K-2 triple valves, 10-20 retaining valves, duplex spring loaded; Creco four-point brake beams with safety supports, with Schafer pressed steel bottom connections and drop forged U-type self-locking hangers are used. All the air brake pins and top brake beam hanger pins are equipped with positive brake pin locks manufactured by the Illinois Corrugated Metal Company. The hand brakes are connected direct to the brake cylinder push rod with a Universal booster introduced in the hand brake rod attachment to develop a pressure equal to the nominal air brake pressure. The Vissering perforated malleable iron brake step board is used.

Report of car inspectors' and foremen's convention

Abstracts of papers on grinding cast iron wheels and prevention of transfers and claims

FOLLOWING are abstracts of the discussions on the papers on lubrication and a progressive system of freight car repairs which were published in the October, 1925, *Railway Mechanical Engineer*, page 627. Abstracts of a number of other papers and discussions presented at the twenty-fourth annual convention of the Chief Interchange Car Inspectors' and Car Foremen's Association of America, which was held at the Hotel Sherman, Chicago, September 22, 23 and 24, are also published in this issue.

Discussion of paper on lubrication

A. H. Herbster (N. Y. C.): The New York Central has a number of dope reclaiming plants and it is surprising the dirt, grit and foreign matter that you get out of the dope that we have not been able to get before, and we certainly agree that the dope is kept in better shape and is better for re-use than it has ever been before. We have found that the waste from the paint and machine shop is not suitable for re-use.

F. W. Trapnell (Kansas City, Mo.): It was stated that in passenger and locomotive equipment, it was necessary to use wool fiber. In freight cars you can use cotton waste of fiber.

M. P. Cole (B. & M.): We are cleaning all the new axles and new journals which we apply, removing all the foreign substances on that journal, applying a little free oil, and making sure that the journal which we apply has a crown bearing. On passenger equipment, one year ago we started to jack all passenger equipment twice a year, in the fall and in the spring. We were obtaining 197,000 miles per hot box, in the passenger service, at that time, and last month we obtained 460,000 miles per hot box.

C. J. Nelson (C. I. I., Chicago): I think one of the first considerations involved in connection with this subject of lubrication, is the use of good material and that means waste, oil, and your bearing surface. It is unfortunate that the selection of the material to be used is not always in the hands of mechanical men. Making a roll too compact is liable to result in an early glaze, and some railroads have had bad results from that practice. One of our worst enemies is the glaze, and it cannot be destroyed without removing the packing from the box. The poor car inspector is to blame for it, but our lubricating expert says "poor oil." The solution is, first class attention and the only way to provide such attention is to arrange more frequent repacking of cars and then get the cars on the repair track so that you can do the work more efficiently.

H. Andrews (N. Y. C.): I was at a session some years ago when you gentlemen were in favor of checking up and inspecting journal bearings once a year, you did well for awhile and then you came to the idea that keeping the cars moving over the railroad was all that was necessary and would accomplish the purpose. If you will go out on the repair tracks and check up after the men whose duties are to properly care for the repacking of journal boxes I am quite sure you will find that if more attention was given to the brasses the cause for many of the hot boxes you are having would be found, and you will come back to this convention next year with a different theory and different ideas. You are not changing the journal bearings, gentlemen, and that is contributing to the cause of the hot boxes.

Discussion on progressive system of freight car repairs

H. Andrews (N. Y. C.): I would like to know if this program is outlined on a day work basis and just what checking up is done.

F. A. Starr (C. & O.): We are working on a day work basis and our production is superior than when we work piece work.

W. P. Elliott (T. R. R. A.): I recall at our last convention we had some discussion on the best way to cut out rivets. At that time I expressed myself as being in favor of the burning out process, but since that time I have changed my mind, I do not believe in the burning out process. I believe that there are rivet busters now on the market far superior to any burning process, that is for rivets 5/8-in. or 3/4-in. I believe that we would not find it so satisfactory for rivets larger than 3/4-in. The greater part of our work in rebuilding cars is on 5/8-in. rivets and our machine now in use is far superior to the burning process.

It is cheaper than the electric burner and the acetylene torch. It costs 1½ cents to cut out rivets with the burner and with the rivet busters we can do it for one cent.

F. S. Cheadle (R. F. & P.): With a shop program like the C. & O. there always will be a difference of opinion as to the best method of removing rivets, whether by burning or cutting, acetylene or electricity. I can absolutely agree that the burning process used by the C. & O. is superior and cheaper than anything I have come across.

E. G. Chenoweth (C. R. I. & P.): I find from my own experience that you should have a good man to deliver material and have in the organization such conditions in which you can return the material not used to the place from which it comes. In moving the cars the tendency is to deliver more material than is used. The effort we have put forth at this time to get this material back again to our storage place has been gratifying and has helped us a great deal, the fact that good material is strewed around cars and is not used is not only due to the man who delivers the material but due to the effort on the part of the workman that save some of the old material that may be still on the car.

One other thing that I want to bring up is the stripping of cars in order to get the rubbish all on one side of the yard. We have set aside two or three tracks for stripping cars for heavy repairs. The car is then moved onto the repair track and this keeps lots of the rubbish away from our repair track and we can concentrate our efforts for stripping at other points. We are working general piece work and I have found that we use about 10 men to strip cars on an average. Piece-work changes with the education of man on repairs, and I was surprised at the statement made today that they found they could get the work out faster in day-work than in piece-work. This has been entirely different in our experience in the past few years, and we have some interesting figures that have been worked up along this line.

We cannot, in a general repair plant, order material so far ahead as outlined in the paper today. We have to adjust ourselves to what is coming in and to the equipment that we may be required to handle. Complications may come up, therefore we have to work very close to the stores department, keeping them advised in advance as to what will be required. In doing this sometimes we have to wait, holding up equipment for a few days waiting for material to come, but it is found by most railroads that this is satisfactory, instead of getting a large amount of material in stock that possibly will not be used for some time.

In routing of cars and delivering material our foremen make out the list when the car comes onto the repair tracks. The foreman who has supervision over making repairs to the cars has nothing to do with the stripping but as soon as cars come onto the repair track he puts out slips for men to deliver material to the particular car. This class of material lies alongside of the track about where we expect to do this class of repairs. We have tried out both moving the men and moving the cars and as near as we can find by making a careful study there is not much advantage one over the other, but I personally would recommend moving the cars instead of the men due to the fact that your material can be put on the side of the track where you expect to use it.

Another thing that comes up in classified work which I was in hopes would come up here today is in arranging a piece work schedule for classified work. That is one of the hardest things to do, due to the fact that a man becomes expert in one class of work and naturally his pay begins to go up. In the beginning he started out satisfactory, this shows that when you classify work on piece work it means pay begins to go up as the man becomes expert in the work to which he is assigned. In this connection I have tried another scheme. We have four different divisions in our shop, of from 50 to 60 men. Each foreman in that department doing the same class of work. Instead of having an expert on each of these divisions or in each part of shop, we have men who do this all over the yard, for instance, like underframes or setting of the roof, etc. In a large yard this would work out all right, but as said before you run into the same thing as piece work; a man becomes expert and you may have to consider schedules again and as many of you know it is not a good thing to consider decreasing piece work prices.

Mr. Elliott: I want to say that I agree with Mr. Chenoweth and disagree with Mr. Starr. I don't think he meant what he said when he said he was getting more work on a day work basis than on piece work.

Mr. Starr: I do not say we are getting more work, I did say that we consider that we are getting more satisfactory results. The contention that piece work makes greater experts of men has not been proven in practice on railroads. We are doing equally as well as under the day work system and are doing it with less supervision, and our men become experts and strive to surpass each other in the quality of their work which must not be sacrificed for quantity.

I do not by any means wish to convey the idea that we have on the ground enough material to last through the year, but we do not start on the program until sufficient material is on hand to carry on the work until other material is received. We keep the stores and purchasing departments advised as to what we expect to do during the year and the material required to carry through the schedule, outlining to them just how, when, and in what quantities material should be delivered to us during the year.

The moving of the cars to the men as compared with moving the men to the cars has not been satisfactorily threshed out so far as railroad shops are concerned, where the shop is not equipped with overhead cranes, especially where cars must be moved by switch engine or by being pinched. When moving the cars to the men quite often delay results on account of gangs or men waiting until the entire track is moved. If you can arrange the schedule so that each cut remains on the track until the close of the day and all switching done after working hours, this surely would be satisfactory, otherwise your men and gangs must wait for cars to be moved.

In removing the arch bars and annealing them any crack and defect is easily detected. When you turn out a

car every piece ought to last until it comes back again for general repairs. Regarding the box and column bolts, if the car is undergoing class repairs and the bolsters are replaced with new, the same procedure is carried out with the column bolts.

The trucks are the most important part of a car, and if you get trucks in good condition you will keep the car off the repair tracks, for about 90 per cent of the defects are due to faulty trucks.

With reference to using labor for repairing furnaces, we use a car repairer helper and there is nothing in our agreement that prevents us from doing so, however, any pipe work must be done by pipe men. What I meant was this, they fill the furnace with fire brick and fire clay so that the oil and gas which we have will heat the rivets.

Mr. Andrews: Is it necessary to anneal the arch bars? In case the box bolts and column bolts are in condition that they might be left in the car, would it be necessary to anneal them?

Mr. Starr: I do not see any objection to annealing arch bars if they are in condition to go back in the car. I do not know where anything could be gained or lost by annealing the bolts, if a bolt is cracked under the head it could be detected easily.

Grinding cast iron wheels

By W. M. Allison

Traveling car foreman, D. T. & I., *Detroit, Mich.*

In the 1924 report of the Wheel Committee of American Railway Association it was strongly recommended that the practice of grinding slid flat cast iron wheels should be adopted as a standard practice of the Association. It was also recommended that the Arbitration Committee give due consideration to the practice and see that changes were made in the rules giving recognition to the ground wheel as a proper wheel for application to foreign cars.

The Detroit, Toledo & Ironton, together with a number of other railroads in the country, have purchased wheel grinding machines and have made extensive tests as to the safety as well as the practical and economical phase of the use of such wheels and it has been proved beyond a doubt that this is an item which would be a great saving to all railroads and can be done successfully without damaging the strength of the wheel in any particular, in fact greatly increases the life of a second hand wheel.

The practice of regrinding cast iron wheels has been in effect on the D. T. & I. for the past two years and before the grinding machine was put in every conceivable test was made from a practical as well as a safety standpoint.

Various manufacturing plants were visited where cast iron wheels were made and wheels examined which had been broken for test purposes. In no case was the chill less than 5/8 in. in depth, and as the A. R. A. has a minimum of 1/2 in. on new cast iron wheels flat spots of from 2 1/2 to 3 1/2 in. can be easily ground out without affecting the chill in any manner, in fact some of the roads grinding wheels claim that even 4 and 4 1/2-in. flat spots can be ground out.

In selecting wheels for grinding we are governed by the condition of the flange, tread and size of slid flat spot, choosing only such wheels that will retain the proper flange height and thickness, as well as proper diameter and hardness.

In our practice of regrinding wheels, owing to the small size of flat spots existing on those re-ground, we have never had to take off more than 1/16 in. to 3/32 in. to clear off the outside defect. The wheels are then given the Brinell hardness test which will show whether or not the wheel is affected by the process and it was found that the Brinell test shows the wheel slightly harder in most cases after grinding than it was before; however, in some few cases the Brinell reading is a little lower as will be shown by the following figures on 10 wheels on which the test was made.

Tests of chilled cast iron wheels

Wheel No.	Brinell hardness	
	Before grinding	After grinding
1	358	403
2	339	381
3	387	363
4	358	405
5	358	392
6	358	429
7	352	423
8	363	392
9	363	411
10	363	360

About two years ago the D. T. & I. had a pair of cast iron wheels cast in 1911 with a slid flat spot 2 1/2 in. which we re-ground and placed under one of our cars. These wheels have been in service since that date. We recently made an inspection of this pair of wheels, which incidentally are still traveling under the same car, and after two years of continuous service are still in good shape.

The machine which we use grinds both wheels at the same time and not only takes out the flat spots but takes out all imperfections or rough spots in the thread of the wheel, making them perfectly round, therefore making a perfect rolling surface which no doubt will in a manner prevent slid wheels and insure the smooth running of trucks.

We have had representatives from various railroads visit our plant and see the machine in operation and we believe that they are thoroughly convinced that this practice not only gives a second hand wheel but gives a far better wheel than the average run of second hand wheels; in fact, we believe that the average re-ground cast iron wheel is as good as a new cast iron wheel as far as the length of life is concerned.

Owing to the great saving which can be made by all railroads by adopting this practice, we believe that the members of this Association should make a careful study of the practice and recommend the adoption of such on their respective lines.

In regard to the charges for such work owing to the cost of installation of the machine required, provision should be made whereby the roads would be allowed to charge a reasonable amount for the reconditioning of such wheel and we understand that this phase is being considered by the Arbitration Committee at this time.

The object of bringing this matter to the attention of this Association is to get every man interested and educated to the great saving which can be effected.

A convenient horse for the wood worker

THERE are many jobs around a wood mill, such as the assembling of doors for wooden hopper cars, doors for refrigerator car hatches, etc., that require the boards to be drawn tightly together for the application of strap hinges and metal braces. Many wood workers use extension clamps for this job. A quicker and simpler method of doing this kind of work is by the use of the horse shown in the illustration, which shows one of the wood workers on the Susquehanna division team, winners of the car building contest held by the Delaware & Hudson

at Carbondale, Pa., May 21, 1925, assembling a bottom drop door for a composite hopper car.

Two pieces of wrought iron bar about ½ in. by 1¼ in., each having one end turned up at 90 deg. to a height of about 1½ in., are bolted to the top of the horse. The turned up ends serve as bearing surfaces for the wedges.

Assembling a bottom hopper door—The boards are drawn together by wedging them between two lugs on each of the horses

The boards for door are laid on the horses, as shown in the illustration, between the two wrought iron lugs. After the boards have been properly lined up, the wood workers drive a wedge between the lug and the edge of the door, drawing the boards together. He then proceeds to apply the bottom angle and hinges.

Educating car inspectors on the C. & E. I.

By R. E. May

District car foreman, Chicago & Eastern Illinois, Salem, Ill.

THE following outlines for the most part the method of educating car inspectors on the Illinois-St. Louis division of the Chicago & Eastern Illinois, which is quite similar to the method used over the entire system. On this division there are four car shops at intervals, each having three shifts of car inspectors and oilers employed in the train yards. At each of 21 other outside points from one to three car inspectors are employed.

Each month a list of 20 questions is compiled on A. R. A. rules, loading rules, safety appliance rules and Bureau of Explosives rules (the questionnaire effective March 1 was extended to include billing rules), these questions being sent to each inspector, foreman, and A. R. A. clerk on the division with instructions to answer them, give the rule reference, and mail them back to the district car foreman's office not later than the third of each month. There they are gone over carefully by the foreman and graded and a record kept of each man's grade. Correct answers, attached to each list of questions, are returned to the men, a typical set of questions and answers being included in this article.

During the month following, educational meetings are held at various points on the division as follows: Salem yard, Villa Grove yard, Mitchell yard, West Frankfort yard and Cypress. In this manner practically all car inspectors are enabled to attend a meeting at which the questions, used as a subject, are analyzed and discussed so that each man gets a thorough understanding of them. In addition, all inspectors are asked to bring up any questions pertaining to interchange, loading, billing, etc., of which they are in doubt, and these are discussed and a decision made. The office in which the meeting is held is supplied with a blackboard 16 in. by 48 in., lined to represent a billing repair card. During the month preceding the meeting a number of errors found on original records of repairs made by inspectors during that period are sorted from the files, and brought to the attention of those in attendance at the meeting.

First, the record of repairs is placed on the blackboard as improperly written by the inspector. The men are then asked to take exceptions, and usually one man is asked to come to the board and write the records properly. Thus all concerned may profit by the errors of others, knowing at future times how records of repairs covering certain limits, should be written. If any questions come up at the meeting which cannot be answered they are referred in writing to the A. R. A. committee of the Chicago Car Foremen's Association.

To test the thoroughness with which the inspectors' duties are understood and put into practice, periodical checks are made on original records and repair cards, the mistakes found being called to the attention of the inspectors responsible so that in the future they will not be likely to make the same mistakes. This plan has been successful in promoting interest and also familiarizes the inspectors with the rules, for, while they are looking up the answer to one question, they are reading the answers to several others. This plan can also be extended to cover instruction in air brakes, steam heat and various other subjects of vital importance to the successful railroad operation.

The men at and in the vicinity of Salem yard have recently organized, elected their officers in the regular manner, and assessed a small sum for dues. The money obtained in the form of dues is used in providing a meal, cigars, cigarettes, etc., for all who can attend, thereby enabling the men to enjoy a social time and get better acquainted with each other. The secretary draws up the minutes of each meeting, outlining all decisions which have been made on various questions, also outlining in the proper manner repair cards or records which have been discussed. These minutes are briefed as much as possible, mimeographed, and a copy sent to all concerned on the division. The minutes of each meeting held at Salem yard furnish additional material for discussion by inspectors who attend the meetings at other terminals. Thus far this system has been very successful and apparently beneficial to all concerned. By keeping a record of the grades, we know the men who need the most training and in the meetings these men are encouraged to ask questions and are given particular attention. In every instance they are just as eager to learn as we are to teach them.

Typical questionnaire submitted to C. & E. I. car inspectors February 1, 1925

Name, John Doe. Occupation, Car Inspector. Station, Salem Yard. February 1, 1925.

Q. 1—Is equipment stenciling required on cars for certain details such as Type D couplers, K-1 or K-2 triple valves, when the stenciled date built definitely establishes the standard of car?.....

Q. 2—Who is responsible for defects caused by sudden stop due to emergency application of air brakes or bursting of air hose?.....

Q. ?—Is it necessary to stencil cars equipped with D type coupler in order to protect them against substitution of the old style M.C.B. coupler?.....

Q. 4—If you received in interchange a car that was being shipped home, loaded on another, on special authority of the owners, for repairs to owners' defects, would you issue defect card for missing material and the labor necessary to repair same?.....
Q. 5—Is it permissible to paint over inflammable placards on empty tank cars when they cannot be readily removed by scraping or soaking?.....
Q. 6—Can lading be placed on top of box or stock cars?.....
Q. 7—What should be done to permit placing load on top of sides on drop end gondolas?.....
Q. 8—Is it permissible to use wooden flat cars having only two truss rods for twin or triple loads?.....
Q. 9—What should be done when necessary to make the width of lading less than width of car on account of long overhanging, or distance between bearing pieces?.....
Q. 10—How many pairs of stakes are required on single overhanging loads, on carrying car; state location? (piling, logs, telephone poles, etc.).....
Q. 11—What kind of a hand brake must a freight car be equipped with to comply with the law?.....
Q. 12—What is the minimum diameter for side hand holds?.....
Q. 13—Is the handle of an uncoupling lever which is 14 in. from side of a car (freight) a violation of the law?.....
Q. 14—What kind of a car must be equipped with vertical end hand holds?.....
Q 15—When single uncoupling lever is used, on which side of the end of the car must it be located?.....
Q. 16—Should packages containing inflammable liquids be entirely filled? .....
Q. 17—How long must charcoal which has been burned in pits or kilns stand in open kilns, or air, before being loaded in a freight car?.....
Q. 18—Is it necessary to place caution signs on track when unloading tank cars on railroad property?.....
Q. 19—When dangerous articles requiring the red label are shipped in the same outside package with dangerous articles requiring yellow or white labels, how should package be labeled?.....
Q. 20—How should interior packages containing corrosive liquids be packed?.....

The above questions are based on the A. R. A. rules, loading rules, Safety Appliance Laws, and Bureau of Explosives regulations. They should be answered by all foremen and inspectors at outside points and terminals, including all men working in train yards, and sent to this office before February 1, if possible, and not later than February 3. All answers should be made as brief as possible and where possible, show rule reference or page number in rule book where answer is found. These questions and their answers will be discussed at the educational meeting to be held in the office of the car foreman at Salem yard, Thursday evening, February 19, 1925, at 6:30 p. m.

R. E. May,
Dist. Car Foreman.

Answers to monthly questionnaire dated February 1, 1925

A. 1—No. A. R. A. Rule 17, interpretation 17
A. 2—Owner's responsibility except as otherwise provided for in Rule 32. Emergency application from rear of train, however, is unfair usage. A. R. A. Rule 32, interpretation 5.
A. 3—Yes. A. R. A. rule 17, interpretation 2.
A. 4—No.
A. 5—Yes. A. R. A. Rule 36, interpretation 6.
A. 6—No. Loading Rule 11.
A. 7—Corner stakes must be suitably reinforced. Loading Rule 9, paragraph F.
A. 8—No. Loading Rule 20, paragraph B.
A. 9—Filling pieces must be placed between the stakes and lading, and securely fastened to inside of stakes. Loading Rule 119.
A. 10—Five pairs. Three pairs should be placed near the bolster at the overhanging end, and two pairs at the opposite end. Loading Rule 132.
A. 11—An efficient hand brake.
A. 12—⅜ in.
A. 13—Yes.
A. 14—Full width platform end sill car.
A. 15—Left side.
A. 16—No. Paragraph 405, page 47, Bur. of Expl. Regulations.
A. 17—Not less than 24 hours. Paragraph 463, page 56, Bur. of Expl. Regulations.
A. 18—Yes. Paragraph 1050, page 110, Bur. of Expl. Regulations.
A. 19—Red label only. Paragraph 309 (f), page 37, Bur. of Expl. Regulations.
A. 20—With the filling holes up. Paragraph 522, page 63, Bureau of Expl. Regulations.

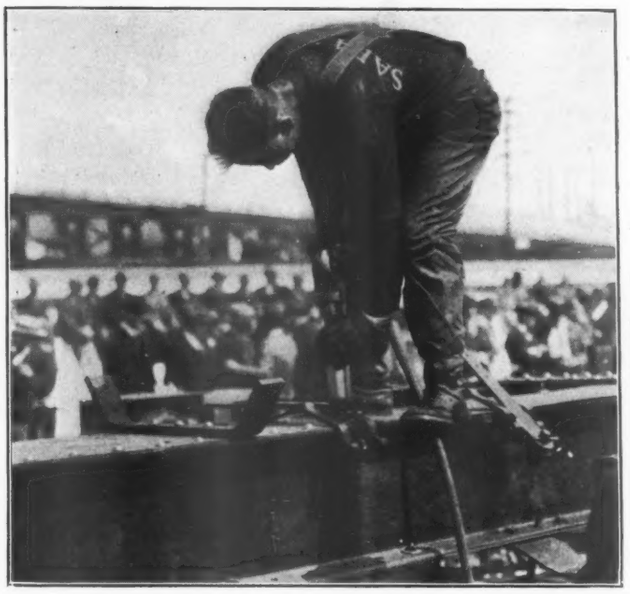
Painted by M. Greiffenhagen, R. A.

"Carlisle, the gateway to Scotland," a poster printed in color by the London Midland & Scottish

Dolly bar for bucking up rivets

ONE of the devices used in the recent car building contest held at Carbondale, Pa., May 21, 1925, by the car department of the Delaware & Hudson, which attracted considerable attention, was a lever dolly bar used by a riveter on the Colonie team. As shown in the illustration, the riveter is able to hold a rivet and buck it up at the same time. This eliminates the services of a second man to perform the work of bucking up.

The device is made of steel bar about ½ in. by 1½ in.

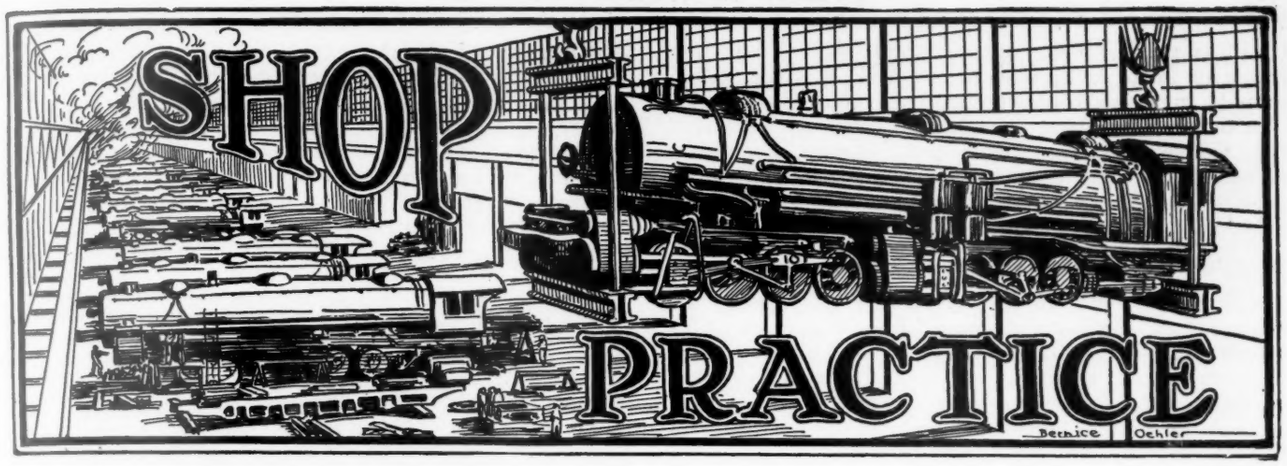


Steel worker driving a rivet and using the lever dolly bar for bucking up

One end is constructed to hook under the flange of the center sill channel and the opposite end provides trunnion bearings for a dolly lever on the outer end of which the riveter places his foot. The pressing down of this lever forces the rivet up tight into the hole and at the same time brings the top cover plate down tight against the flange of the center sill channel.

THE CHINESE GOVERNMENT railways have adopted uniform accounting for their shops. The charges have been divided into two categories, power and general. In shops where absence of electric or steam meters prevents accurate distribution of power costs, machines are to be given a horsepower rating and the use of such machines will be timed in the same manner as time is kept for labor. General charges and power charges are first debited to respective suspense accounts, which accounts are cleared by fixed rates per machine horsepower hour and fixed percentages on labor costs as jobs are completed. These rates and percentages are to be revised as necessary in order to maintain balances at a minimum, due allowance being made for seasonal fluctuations.

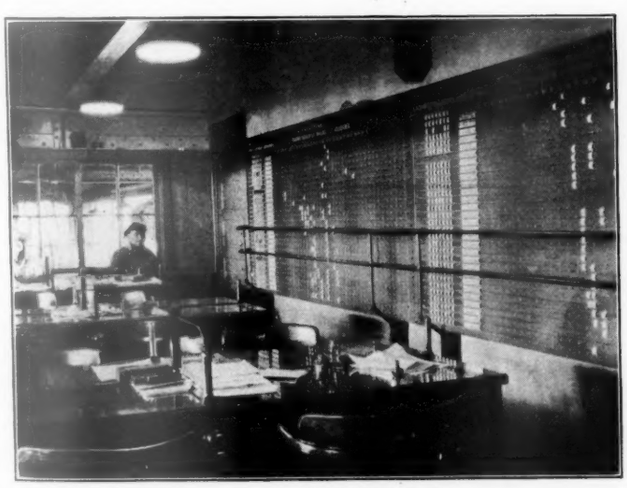
Foundry costs are treated similarly, the foundry suspense account being cleared as good castings are delivered at a uniform rate per pound or per kilogram. Articles manufactured for stock or for other departments may thus be priced on delivery, thus avoiding one of the most serious difficulties in Chinese material accounting. Due to the limited education of foremen in shops, assignment of workmen to jobs is to be accomplished by means of boards upon which the job number is chalked, under which workmen's number checks are hung. Timekeepers will record these assignments four times daily, broken time to be estimated in consultation with foremen. An attendance record is made out by a similar process at the entrance gate and the two records, one in the shop and the other at the gate, are to be compared daily.



Some impressions of Burnham locomotive shop

Improved morale evident at new D. & R. G. W. shop— Effective routing and material delivery systems— Time saving shop devices

THE new locomotive shop of the Denver & Rio Grande Western, located at Burnham on the outskirts of Denver, Colo., and described on page 491 of the August, 1924, *Railway Mechanical Engineer*, holds much of interest in the way of modern equipment and effective shop methods, developed since it was placed in operation about 15 months ago. In common with most railroad shops during this period, Burnham has not been forced to anywhere near its maximum productive capacity and consequently a comparison of the locomotive output, before and after the erection of the new facilities, would hardly give a fair measure of their value. In spite of this fact, however, the output per man employed has increased substantially. The record shows that in 1923 the average number of men working in the locomotive department at Burnham was 521, the average output being eight heavy repair locomotives a month. For the first nine months of 1925 the average force employed in the locomotive department was 384 men, or a decrease of 26 per cent, the average output dropping to seven locomotives a month, or a decrease of only 12½ per cent. The 1925 locomotives received on the whole appreciably heavier repairs than those put through the shop in 1923.



Interior view of formen's office showing glass top desks and master schedule board with guard rail on the wall

Aside from the question of output, the visitor at Burnham shop will probably be most interested and impressed by its excellent design and construction, fine day- and night-lighting facilities, and the full complement of modern machinery, described in detail in the preceding article in the *Railway Mechanical Engineer*. Other points which may strike the attention are the exceptional cleanliness and order apparent in all departments of the shop, the high standard of morale evident among the men, the effective shop schedule or method of routing locomotives through the shop, and last, but by no means least, the shop delivery system which gets material from the stores department where needed, when needed and with the least possible delay.

While the importance of order and cleanliness may sometimes be over-emphasized, railroad shops are not commonly subject to that criticism. More often they are dirty and congested, even with an average output, and when a sudden demand comes for power and the shop is filled with locomotives, this congested condition becomes a serious handicap in any attempt to obtain the desired output. Doubtless Burnham shop will present a different appearance when every pit in the erecting shop is occupied by a locomotive undergoing repairs, and various parts of the machinery, boiler and accessories are scattered throughout the shop. The present orderly handling of the work, however, indicates that when the rush comes, Burnham shop will be in a position to handle

it with a minimum of confusion and lost motion. An important factor in keeping the shop clean is the "Clean Shop Banner" awarded weekly to the department which is in the best condition as regards order and cleanliness. This banner is highly prized and provides a constant incentive for each department to do better than its neighbor in the matter of keeping cleaned up and picked up.

Morale—activities of the employees' organizations

A high standard of morale is evident among the employees at Burnham shop and the friendly spirit of co-operation which exists between the supervisory officers and men means much in the way of better working conditions and more efficient shop operation. It may not be amiss to trace the development of this morale and mention some of the means used to foster it.

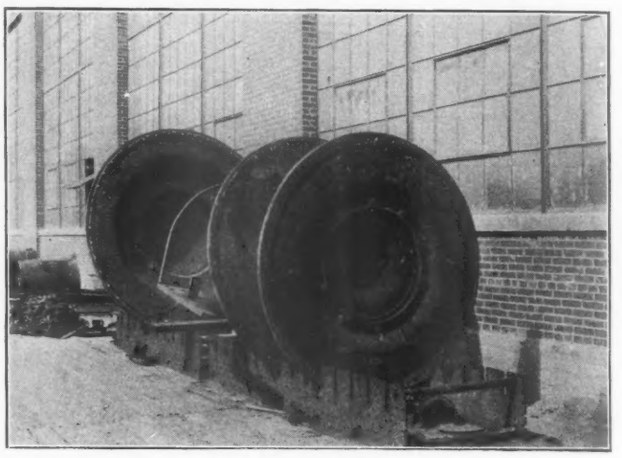
In the fall of 1922 the majority of the foremen at the Burnham shops of the Denver & Rio Grande Western were men who had been with the road a number of years and these, with a few of the older experienced men who acted as instructors, set the pace and standards of work for the new men as employed. Ample supervision was furnished to insure that the work would proceed in an orderly and efficient manner.

Local and system shop organizations were effected, to which the foremen gave their support, as it was quickly determined that with such organizations the foremen were able to direct operations efficiently and gain the interest of the men in producing desirable results.

The men, employed on probation, were naturally anxious to demonstrate their ability. A graduated scale of pay, based on ability, was put into effect with provision for an increase in rate when justified. Under this arrangement helpers are advanced to craftsmen. As there are two shops, one at Burnham and another at Salt Lake, identical in design and practically so in equipment, competition and friendly rivalry is stimulated on similar jobs and classes of equipment between the two shops. The men are interested in the superiority of their shops to the same extent that the supervisors are.

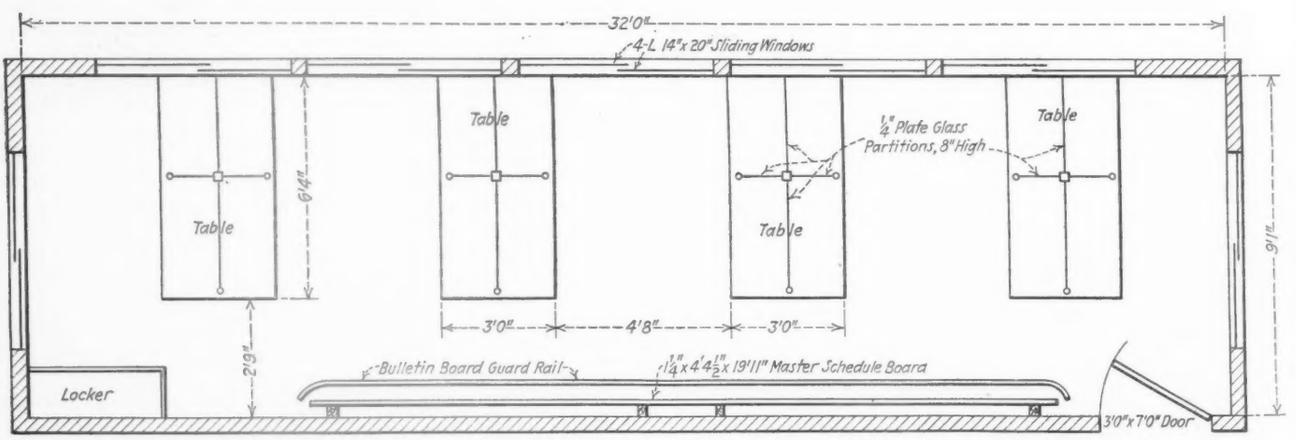
The terms of agreement between the Denver & Rio Grande Western and the mechanical department employees are given a fair interpretation and in cases of doubt are decided in favor of the men. In addition to the new shop buildings with their good heating, lighting and sanitary facilities, every effort is made to maintain desirable working conditions. Heavy manual labor is largely eliminated by the crane and hoist facilities with power tractors and trailers for the delivery system. In assigning men to work, consideration is given to their physical ability and so far as possible men are given work for which they have an aptitude and liking.

Suggestions made by the men are considered by the supervisory board and when adopted are put into service and credited to the originators. If used at other points, a drawing is made and credit given thereon. Grievances are taken up by the shop committee with the department foreman, the general foreman, or the general mechanical superintendent, if necessary, prompt action being taken to adjust any grievances found to be justified.



These racks save space in storing smokebox fronts

One of the most important activities of the employees' organizations is that of the Scenic Line Service Club at each division point, composed of employees and officials of all departments. This club helps cultivate better acquaintance of the members and furnishes an opportunity for talks by employees and officers on any subject pertinent to the interest of the company and employees.



All department foremen have desks in the centrally located general foreman's office at Burnham locomotive shop

A safety committee composed of representatives of all the shop departments meets monthly to consider all suggestions made regarding methods of eliminating unsafe practices and in this manner safeguarding the workmen. To take care of minor injuries and afford first aid in serious cases, an emergency hospital is located conveniently on the shop premises and contains a full complement of sanitary equipment. The rules require that every accident, no matter how minor, providing it involves a break in the skin, be reported in order that the wound may be properly

dressed. A mutual organization provides medical, surgical and hospital service for a small monthly fee.

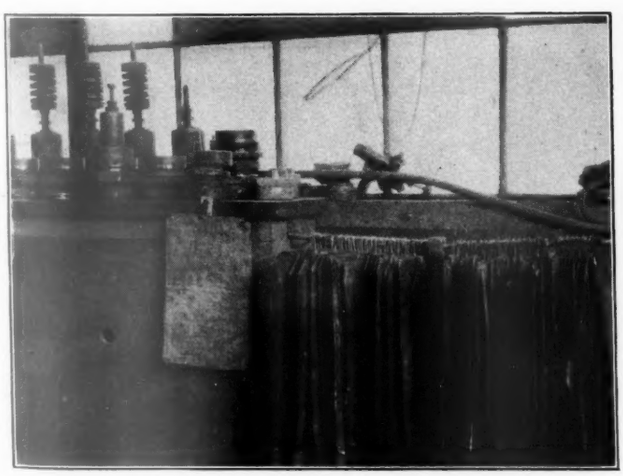
An important feature of the organization work is the stimulation of better acquaintance through various social affairs. The shop band, composed of shop and office employees, furnishes music at meetings, dances and picnics. The dances are managed by the men and held several times during the year. The picnics are annual affairs on each division, for which the transportation is

A departmental schedule board and telephone for ordering material and inter-shop communication

furnished by the company. In addition, inter-shop ball games are played between teams at different points.

The company magazine also is an important factor in encouraging loyalty to the company, containing as it does contributions from all classes of employees on any subject of interest, together with personals, special educational articles and records of accomplishments. There is also a crafts magazine published by the men.

The company encourages relief activities, a special



A convenient blue print rack in the brass room

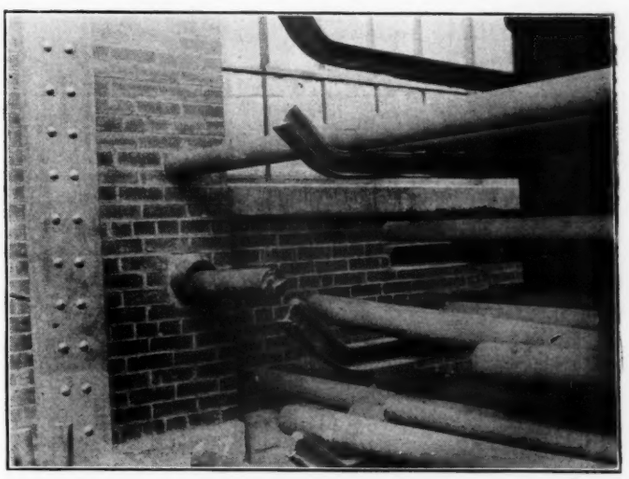
representative investigating needy cases and arranging relief through organized agencies. The pension system provides an annuity for employees reaching the retirement age.

Shop schedule simple and effective

The shop scheduling system which has been developed at Burnham shops is based on the system installed at the Silvis shops of the Rock Island and previously described at some length in these columns. Certain changes have been adopted, however, which seemed advisable to adapt it to local operations.

A master board is located in the general foreman's office, the engine numbers and dates being transferred to departmental schedule boards as required. When a locomotive enters the shop the general foreman sets the date for boiler test and engine wheeled, the schedule clerk then setting all the other dates.

The general foremen's office is also a general office for all department foremen in the plant, with a desk for each one as shown in the floor plan drawing. A meeting is held during every noon hour and a check made of the master schedule board with particular reference to any delays indicated by red tags. With all of the foremen present the cause of the delay can be quickly located and steps provided to take care of the matter. The arrangement of the foremen's office has proved very efficient. It forms a common center where they are all available to each other except during working hours. They are much less inclined to spend time in the office than was the practice when each had an office in his own particular section of the shop. The entire office is visible from the machine and erecting floors so that a man can readily be located



Bar stock for the turret lathes passes directly from the rugged storage racks through a hole in the shop wall to the machines with minimum handling

if he is in the office. At the same time, anybody in the office has a good view of the locomotive shop building.

With the work closely subdivided on the departmental board, each foreman watches to see that the work is delivered to him on time in order that he may get the full benefit of his allowance of time. On this account each man voluntarily traces on the department which handles the work ahead of his. There is no chance to "pass the buck" and fictitious alibis are easily exploded.

A four o'clock report of material delays, showing the locomotive or shop order number, kind of material, amount, pattern number and date ordered, has been developed which eliminates much waiting for material. It furnishes the shop with a quick record of the material situation, and the division storekeeper is reminded daily of the shop needs. The copy sent the mechanical engineer is checked by him and the general storekeeper in order to straighten out any weak points in the material supply situation. This also provides for furnishing material from other storehouses if available. A marked improvement has resulted in the material situation.

Material is not entered on the four o'clock report more

than once. In other words, if rivets are out of stock for three days the only four o'clock report on which this material shows is one made out on the first day the shortage was noted. The schedule man, before turning in the four o'clock report, checks it with the general foreman who notes thereon if any different arrangement has been made on account of the material being out of stock. In other words, if a casting is ordered and found to be out of stock and the shop makes a forging to do the work in order to keep the engine up to schedule, the general foreman notes this fact on the report. This shows the stores department that it is not necessary to order this casting specially for this engine even though it is out of stock. The stores department shows under the heading, "For store supply," the status of items reported out of stock, giving as nearly as possible the expected date of delivery. This information is entered on the report at once and the original copy returned to the general foreman the same day. The general foreman then goes over the report with other foremen interested so that everyone concerned is acquainted with the situation.

Prompt material delivery

One of the important factors in the success of the Burnham shop operation is the arrangement made for prompt and efficient handling of material from the stores department to the various shop departments as required. In accordance with a practice which has come to be quite common in modern shops, the various steel columns or stations throughout the shop are marked with a combination of letters and numbers by means of which foremen can designate where they want material from the stores department left. At Burnham, however, the "pick-up system," or customary practice of leaving material orders at the various stations to be picked up and subsequently filled by a stores department material trucker on his regular rounds, has been discarded to the extent that orders are transmitted verbally. Telephones

Portable steam dome platform which facilitates throttle work and promotes safety

provided in each of the important shop departments enable the foreman or other authorized person to have immediate communication direct with a stores department switchboard devoted exclusively to shop delivery and attended by an operator who is an experienced stock man. Orders from all parts of the shop, therefore, come to this one switchboard and the operator either knows or can find out immediately whether the material requested is available and if not whether substitute material can be provided. The prompt transmittal of this information to the foreman over the telephone not only saves a great amount of time spent in writing orders for material not in stock, as well as many unnecessary trips between the shop and stores department but materially speeds up shop operations.

On receiving the verbal request over the telephone for material the shop delivery switchboard operator fills out the order or requisition which is taken together with the material to the shop by one of the material truckers who brings back the signed requisition on returning to the stores department. Power tractors with suitable trailers

Standard templets are used to save time in laying out boiler sheets

are used for handling material and besides saving manual labor, get the material to the shop with the least possible delay. Experience has shown that 15 min. is the average time required for the delivery of material orders with this system. A particular advantage of the telephones is that in case of emergency and where the material is in stock, immediate delivery can be obtained. Since installing this system and using power tractors and trailers, the force employed in trucking material at the Burnham shop has been reduced at least 50 per cent.

Labor saving shop devices

One of the illustrations shows a portable steam dome platform which has proved helpful in the handling of throttle work as well as in providing greater safety for the men who are doing this work. This platform consists of a built-up steel and wood platform 6 ft. square and having a hand or guard rail made of 2-in. pipe or flue material, 2 ft. 6 in. above the floor. A hole 3 ft. 9 in. in diameter is provided in the center of the platform, enabling it to slip down over the largest steam dome, most of the weight being supported by the platform floor resting on top of the boiler. Stability is secured by means of four V-shaped brackets, two of which bear on the barrel of the boiler on either side of the dome. The two brackets on the left are shown in one of the illustrations. These brackets are made of 5/8-in. by 4-in. bar stock, riveted to the platform floor. Two hooks are provided on opposite corners of the rail to which the crane chain hooks can be readily applied. They serve to lift the platform from the erecting shop floor onto the boiler or back to the floor again as may be required.

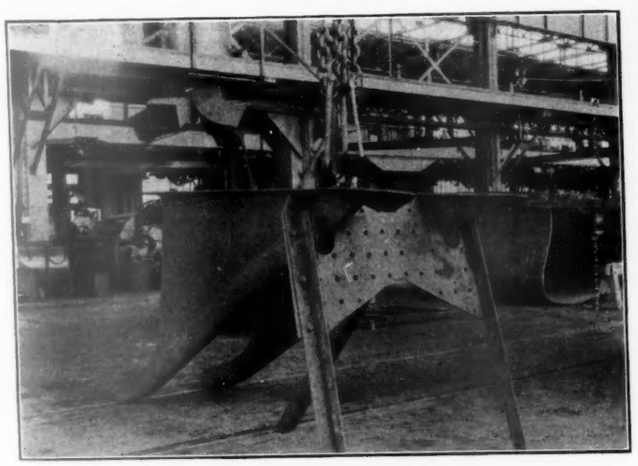
Solid and tubular bar stock of all kinds is kept outside of the locomotive shop in rugged racks built up of heavy timbers with horizontal rail sections and provided with umbrella type roofs as a protection against rain. When certain of this stock is required to be worked up in tur-

ret lathes in the shop it is passed directly to the machines through a hole in the shop wall as shown in one of the illustrations. This is merely a simple method of saving work in handling the heavy bars.

An effective method of handling shop blue prints is in vogue at Burnham. It consists of mounting commonly used blue prints on scrap sheet iron of standard sizes and hanging them on suitable racks. Shellac is used both to

By means of this pair of horses, boilers can be rotated and blocked in position for boilermakers to work to the best advantage

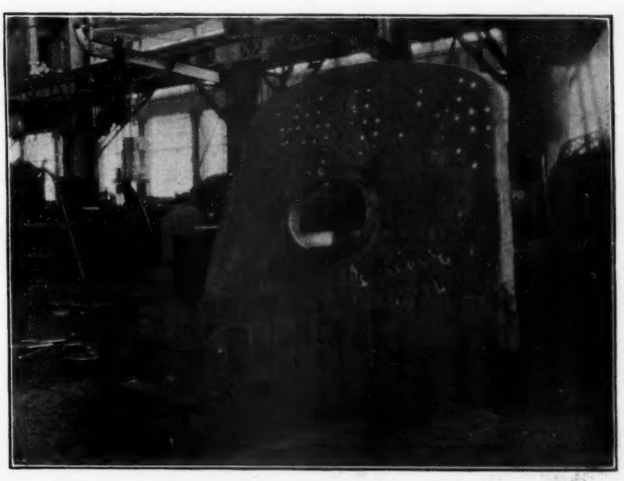
make the blue prints adhere to the sheet iron and as a surface protection against oil and dirt rendering the prints unreadable. A hook riveted to each sheet, as shown in one of the illustrations, enables the sheet and blue print to be suspended in its proper place in a compact rack in the toolroom or, when out on the job, from some part of a machine or bench where it can be readily seen. As a result of this method of handling blue prints they take up



A convenient stand for use in applying Nicholson thermic syphons

minimum space when not in use; any particular print may be readily found when required; durability is secured and blue prints when at the machines or work benches can be used with maximum convenience. The main filing rack in the toolroom consists of a substantial angle or T-iron supported on 2-in. by 4-in. diagonal wooden legs at a distance of 4 ft. 9 in. above the floor. Beneath the angle iron, and supported at about 12-in. intervals from it, is a ½-in. rod from which the blue prints are suspended by means of the hooks. When a considerable number of blue prints are used constantly on a particular job, as in the brass or air brake room, they are kept at that point on a small rack which may be placed in some corner where it will be convenient but out of the way.

The problem of storing smoke box fronts is often difficult, particularly in a congested shop, and one of the illustrations shows how simply this is handled at Burnham. A rack built up of ½-in. or ⅝-in. scrap boiler plate, and having slots of suitable size and properly spaced cut with the oxy-acetylene torch in the upper edges of the rack, is located outside the shop building. After a smoke box front is removed from an engine in the shop for general repairs or other work involving the renewal of front end netting and parts, a storage battery truck with jib crane attachment picks up the smoke box front and carries it out of the shop, setting it down in a vertical position in one of the slots in the rack. By this means it is taken completely out of the shop which may be otherwise congested, occupies a minimum space while being stored, and moreover is set in such a position that there is no danger of workmen falling or tripping over it. It will be observed from the illustration that the two sides of the rack are held together by suitable tie rods, the proper spacing



Completed or partially completed flue sheets are placed in this truck on which they take up minimum floor space and are readily moved about the shop

being secured by scrap tube sections of the proper length.

Templets are used in laying out standard boiler sheets saving an immense amount of time and assuring accuracy. Each templet when in use is clamped to the boiler sheet during the laying-out process to obviate any possibility of slipping while the center punch marks are being transferred through the templet to the boiler sheet. A complete set of templets is kept under the horses shown in the illustration.

The method of renewing fireboxes at Burnham is to strip and cut off the entire back end of the boiler, using an oxy-acetylene cutting torch. The back end is then taken to the boiler shop and supported at approximately its center of gravity on two horses as shown in one of the illustrations. The horses are built up of channel and I-beam sections riveted together and of sufficient strength to support the heaviest back end. The weight of the back end is transmitted through two trunnion plates to bearings on the horses and, by means of suitable blocks and a clamping arrangement, the back end can be held in whatever position may be most convenient for the boilermakers who are renewing staybolts, mud ring rivets, or other work. In other words, this arrangement makes it un-

necessary for boilermakers to apply staybolts and rivets upward or at an angle which may make the work difficult. Any necessity of working in a cramped position or limited space is avoided.

The operation of applying Nicholson thermic syphons to boilers is somewhat awkward owing to the shape of the syphons and the rather limited room in which the boilermakers must work. The three-legged, built-up sheet metal stand illustrated has proved especially convenient for this purpose, there being slots in the upper part of the stand to hold the pair of syphons at the correct distance apart and approximately in the position they will assume when in the firebox. The boiler back end is then lowered down over the syphons, the upper edges fitted into the openings in the crown sheet and welded and the entire operation performed with much less difficulty than if the syphons had to be held in position entirely by hand.

A three-wheel truck, designed for holding and transporting various flue sheets and other boiler sheets about the shop is also illustrated. This truck consists of a substantial boiler sheet framework supported on three truck wheels and provided with slots of different widths cut with the oxy-acetylene torch in such a way that boiler sheets in various states of completion as regards forming the flanges, can be held upright in the truck. The sheets will in this way take up comparatively little floor space and may be readily moved about the shop.

Safety covers for water type ash pits

THE water type of ash pit which is quite commonly used at the majority of modern engine terminals offers many advantages over the older types of pits, but at the same time, presents an element of danger

The covers are supported against the cars and must be lowered before the cars are moved

which has proved to be quite difficult to eliminate—the possibility of ash pit men either falling in the pits or unconsciously stepping off the wrong side of a locomotive and into the pit. The two illustrations which accompany this article show two different arrangements installed at the Joliet, Illinois, engine terminal of the Elgin, Joliet and Eastern, that have successfully eliminated the dangers in connection with the instillation of an uncovered, open water type of ash pit.

There are two ash pits at this engine terminal, one illustrated in each of the pictures. It will be noticed that on one of the pits a grating constructed of boiler tubes has been laid between the rails over the pit, and on the inside of the pit track towards the center or service track has been placed a runway with a railing, so that no matter from which side of the locomotive a man should

The runway on the pit side eliminates the danger of a man alighting from the wrong side of a locomotive

happen to alight, there is no danger of his falling into the pit.

The arrangement of the grating over the other pit seems to be still better. Many railroads throughout the country have devised gratings to be placed over ash pits of this type and it may be safely said that in the majority of instances, these gratings may be placed over the pits in such a manner that the operator on the ash pit crane may pick up the gratings and lay them on the ground while cleaning out the pit with the clam shell bucket. Gratings arranged in such a manner have one disadvantage in that it is very easy to neglect to replace them when through cleaning out the pit and, as a consequence, they fail to serve their purpose. The arrangement shown in the second illustration differs from the ordinary type in that the gratings are hinged to an I-beam support which runs along the pit adjacent to the center or service track so that when it is desired to remove the ashes from the pit with a clam shell bucket, these gratings are raised and must be supported against the cars on the service track. It can readily be been that it is almost impossible to move the cars from the service track after the pit has been cleaned without lowering the grating into place and in this way, the fact that they are hinged and rest against the cars serves as an automatic safety feature. The gratings themselves are constructed of light weight material principally a light angle iron outer frame and cross bars of 2-in. boiler tubes flattened at the ends and riveted to this frame. Over these cross bars is laid a close mesh netting and a plank runway. It will also be noticed that there are cross bars between the rails of the ash pit track which support a grating that is just beneath the surface of the water in the ashpit.

The crane type truck as it is used for applying side rods.

Electric trucks in the locomotive repair shop

The practice of one railroad indicates that this equipment fills a definite need

By Harold J. Payne
The Society for Electrical Development, Inc.

THE size of modern steam locomotives is so great and construction is so complex, that the problem of stripping and rebuilding requires special facilities. The overhead traveling crane is indispensable in this connection and given sufficient time, can handle all of the work to be done. In the particular shop in question, however, 40 locomotives are placed at a time in each of two buildings and although each building is equipped with two cranes, it is still found that this apparatus is not equal to the number of tasks imposed upon it. Since in addition to the boiler tubes, 125 or more parts have to be taken off and replaced on each engine that is completely overhauled, this can be readily understood.

An elevating platform truck used as a tractor

Another class of work for which it has very commonly been found difficult to find adequate equipment in such shops is the handling of parts from the locomotive to the various sections of the repair shop where cleaning machining, forging, annealing, etc., are done. Distances are frequently long, parts are heavy and are moving between points that vary considerably in location from hour to hour—especially as in this case where 80 locomotives are being repaired simultaneously. Quite evidently any carrier that is to work out in such service must be at the same time sturdy in construction and flexible in operation.

Storage battery trucks adopted

With these two problems in hand the shop under discussion decided about four years ago to experiment with storage battery trucks as a possible solution of these difficulties. The original idea was to provide auxiliaries for the heavy cranes and for hand trucks. That being the case two types of truck were put into the service, the load carrying crane and the elevating platform. At present the management finds itself convinced not necessarily of the particular make of equipment nor the particular modifica-

tion in use, but of the suitability of trucks for this kind of service. It can be said that each of the eight machines in service does more work than five hand truckers. The more or less intangible results that have been achieved, however are of still greater importance.

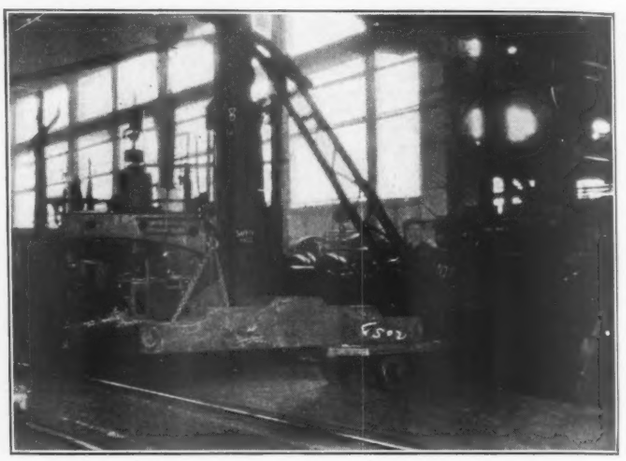
The most important of these is the supplementary service rendered the overhead cranes. Formerly when a part was ready to be raised or lowered, it was necessary for the crew to wait for the overhead crane; time was unavoidably lost since it was a physical impossibility for two such machines to be in a half dozen places at a time. With the crane trucks now performing all of the lighter jobs the traveling cranes are always available for the work for which they alone are fitted such as lifting a rear end or front end or perhaps moving a boiler. By far the larger number of parts stripped weigh under three tons and are located within easy reach of the boom of the crane truck. Consequently, this work has been largely assigned

The boom is long enough to remove parts from the top of the locomotive

to these auxiliaries, with the result that taking down and building have been generally accelerated. Furthermore, idle time on the part of repairmen has been cut down and in some cases the number of moves necessary to perform a given job has been decreased. For instance, when a couple of driving rods are taken off that are needed immediately in the machine shop, the crane truck drops them onto the platform of its own chassis and delivers them to the machine that is to do the work, traveling a thousand feet and back again, probably dropping a load of finished parts by a nearby job on its return. By the time it is needed again for another job, on the locomotive being stripped, it is ready.

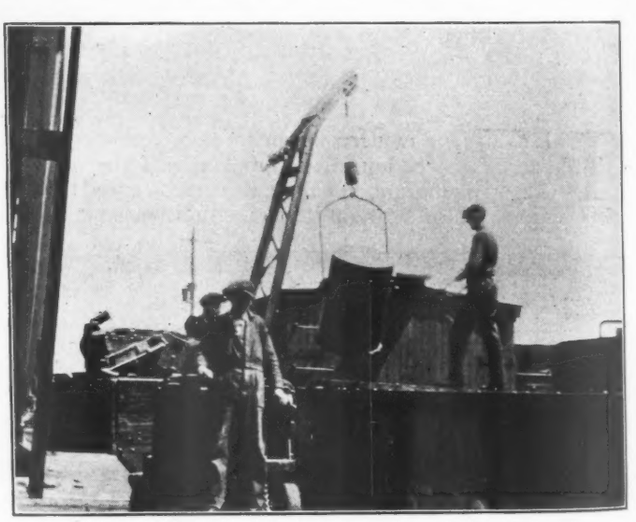
Work done by elevating platform trucks

The elevating platform type of truck with skids supplements the crane type in the work of moving the parts through process. Wooden platforms and metal box skids are used in connection with these trucks which are constantly on the move between the locomotive shops and the other departments. In general the metal boxes are used in the blacksmith shop for taking parts that are still hot directly from the workman or the machine, as the case may be, so that rehandling may be altogether avoided. The wooden platforms are used for all parts up to three tons, a typical load consisting of six or eight locomotive truck springs. It is impossible to detail the jobs done by the storage battery equipment because of the fact that it is used very much as are machine tools. In other words, the



Large castings are carried on the chassis with the aid of the crane

truck is a tool called upon to lift, carry or pull, irrespective of the nature of the job, so long as the total load does not greatly exceed the known capacity of the trucks, a capacity somewhat greater than the two tons in this particular case, which is guaranteed by the maker. Perhaps by citing a few "odd jobs" for which the trucks have indicated fitness through their performance, a somewhat



Chips are carried out and dumped into scrap cars with the crane type trucks

clearer picture of what they are accomplishing may be gained.

Saving on chip removal

Formerly nine wheelers were busy all day long keeping the machine shop clear of chips. The distance that had to be traveled to the siding on which the car was placed that carried away these chips frequently exceeded 1,000 feet and always included a curving up grade of about 6 per cent, 40 feet long. When the crane trucks came into

use the experiment was tried of carrying out the chips in cans, each holding the equivalent of six wheelbarrow loads. On every trip the truck carried four to six of these containers. The net result of this innovation has been a reduction of the labor involved to that of two truckers, each with one helper, working only one hour and 20 minutes a day. The congestion caused by nine wheel barrows constantly moving through the shop has been eliminated. This was particularly gratifying as the aisleways are exceedingly narrow considering the volume of material necessarily constantly on the move. Actually the main runway through the machine shops that are placed at right angles to the locomotive shops, is not over seven feet wide.

Boiler tubes when removed for cleaning and safe ending are placed behind the locomotive on a special flue wagon that runs on standard gage track. When the load is ready, it is run out onto the transfer table and from the table to the flue shop. Formerly 10 men were required for placing the flue wagon on the table and later for pushing it into place in the shop. By the method at present in use, a truck of the elevating platform type

Elevating platform used for unloading wheels from a car

is used to haul the load of tubes. The truck is coupled to the flue wagon and the machine used as a tractor has no difficulty in moving the load. One man can do the job in a shorter time, and entirely without physical effort, that formerly demanded 10 men normally at work on other jobs.

Special spring bumpers have been attached to the front end of the platform trucks to fit them for shoving loads that may be placed from time to time on other wagons or push cars that run in the main aisleways on a standard gage track. Again the trucks are used in spotting cars when a switching engine is not immediately available. Regularly the platform trucks work between the stores department and the various sections of the plant delivering such supplies as may be needed. With equal regularity the crane trucks are used for loading outbound motor trucks carrying heavy stores for shipment to other plants or roundhouses. The complete flexibility of the crane truck is a great advantage in such loading where quarters are tight and overhead cranes are not available.

Building a transportation system

It is clear that in order to keep all of this fleet of 8 units operating efficiently at all times, a transportation organization is desirable. This has been recognized and one man has been given complete charge of the equipment and is entirely responsible for service rendered. The foremen in charge of various sections of the shop are expected to make known to him any special work that is to be done. To speed up movements and to reduce the number of empty runs, a system of flags has been adopted for placing on work waiting to be moved. These are small metal markers, painted yellow with a black letter designating point of destination. The first driver passing such a job without a load is expected to pick it up and move it. The transportation chief is constantly alert throughout the various shops making sure that no jobs are being neglected and dispatching the truck drivers for special work when need arises. Special effort has been made in assigning definite jobs to various truckers to reduce the time to a minimum that they must travel empty.

Another man is constantly at work keeping the trucks in good running condition and preventing truck failures. This man is able to inspect all of the trucks regularly and to make sure that they are properly lubricated.

Although costs of operation are not known definitely at this shop, other data reveals that a charge of $4 a day per truck covers the items of interest, depreciation, maintenance and power in similarly heavy service. Beside saving five times the wage of a hand trucker at a cost of about $4, many worthwhile changes are made possible in shop routine.

The electric industrial truck is seldom thought of as a machine tool, yet performance in this locomotive repair shop justifies the contention on the part of the management that it falls naturally into this class of equipment and that as such it has come to stay.

Cooling and drying compressed air

By J. B. Leonard
American Blower Company, Detroit, Mich.

THE problem of eliminating moisture in compressed air is one which has proved a source of worry in many industries throughout the country. Varied have been the remedies which have been applied but in the opinion of the writer, an installation such as the one at the car shops of the Michigan Central, Detroit, Mich., has many distinct advantages, both from the standpoint of effectiveness as well as cost.

These shops were using compressed air in large quantities for operating pneumatic machine tools. This, of course, meant that the air had to be practically free of moisture. In order to solve this problem, it was finally decided to install a system for cooling and drying the compressed air, an elevation and floor plan of which is shown in the sketch. This system is comparatively simple and when once installed, requires little attention. The installation, as shown in the sketch, consists of four No. 40 American Blower pipe coils which are made of standard 1-in. pipe set in cast iron bases of 5 ft. 6 in. and 5 ft. 9 in. length, respectively. Each coil has 160 vertical pipes, arranged with 40 tubes in a row extending the length of the base and four rows wide. The bases are of special construction, having a vertical web along the entire length, dividing the base into two distinct chambers, so that the compressed air will follow different routes and eliminate any possibility of short circuiting.

Referring to the floor plan of the sketch, it will be noted that these coils are used as aftercoolers, designed

to reduce the temperature following the final compression, thus removing a large portion of the moisture content. It was found advisable when operating during the winter months to eliminate all of the moisture possible from the compressed air before it entered the pipe lines, as frost accumulated on the inner surface of these pipes, increasing the pressure drop at the end of the line. In the accumulation of this frost, the walls of the pipe tended to serve as a surface condenser which caused moisture to form on the inside.

A two-stage air compressor, having an intercooler between stages, is used to compress the air to 100 lb. gage pressure. The amount of heat to be removed per hour with a capacity of 1,000 cu. ft. per min. at 100 lb. gage is approximately 600,000 B.t.u. The temperature of the air after leaving the compressor is 225 deg. F., which is reduced to approximately 90 deg. F. after passing the cooling system to the storage tanks.

No use is made of the heat extracted from the compressed air and no provision was made for the mechanical circulation of cooling air around the coils to increase the radiating capacity. One-fourth of the total volume of the compressed air passes through each coil, thus maintaining the velocity within a practical figure. The radiation factor found to exist with this installation was considerably higher than expected, due perhaps to the coils being located outside the building and a comparatively high velocity of air over the coils.

The recommended radiation factor, loss in B.t.u. per sq. ft. per degree drop in temperature per hour, should not exceed three, under the conditions occurring in this installation. In the analysis of a problem such as this, it is advisable to prepare a heat balance between the heat in the compressed air which must be removed and the radiating capacity of the pipe coils sufficient to handle the job. The following formula is used for determining the amount of heat that must be removed from the compressed air per hour:

$$\text{B.t.u.} = \frac{60\ C_1 T}{55}$$

in which
C_1 = the cubic feet of free air entering the compressor per minute.
T = the temperature of the air leaving the last stage, minus the temperature desired at the coils.

The volume of free air entering the compressor may be found by the use of the following adiabatic formula;

$$C_1^{1.41} = \frac{P_2\ C_2^{1.41}}{P_1}$$

in which
C_1 = the number of cu. ft. per min. of free air entering the cylinders.
P_1 = absolute atmospheric pressure.
P_2 = absolute pressure at the last stage.
C_2 = the number of cu. ft. per min. leaving the last stage.

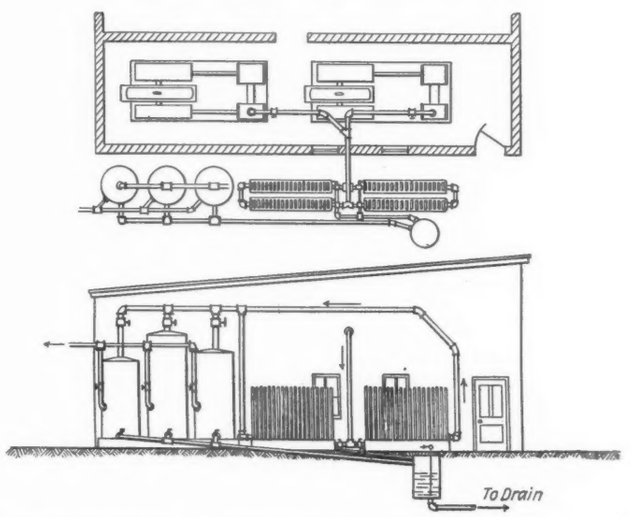
The moisture contained in the compressed air at any point of the system may be found by simply applying the conditions of temperature and pressure existing at that point to the following formula taken from Kent's Mechanical Engineer's Handbook:

$$W = \frac{KH}{2.036\ P - H}$$

W = the weight of water in pounds.
K = the ratio of the weight of 1 cu. ft. of saturated air to 1 cu. ft. of dry air.
H = the elastic tension of water vapor.
P = the absolute pressure in pounds per square inch.

Each of the coils must have two drain pipes to the condensation tank on account of the center web, the valves being left open continuously. The condensation tank is emptied periodically by turning a lever which is located on the floor directly above the drain tank, buried in the ground in front of the right hand coils, as shown in the sketch. The opening of this valve permits the pressure of the air above to force the water out at the drain pipe.

Calculations show that the moisture content of the air, with 100 lb. gage and 90 deg. F., to be approximately 25 grains per pound of air. The success of this installation is apparent when one realizes that the moisture entering the system was approximately 100 grains per pound of air. In a plant of this capacity, about five pounds of water enters the first stage of the compressor per minute. Half of this is eliminated at the intercooler, where the pressure from the first stage is about 30 lb. gage and the temperature is reduced by the cooling water to about 85 deg. F. It is possible with the cooling capacity of this installation to extract an additional 1¼ lb. of water per minute, which necessitates a condensation tank having



Sketch showing the compressed air cooling and drying system in the car shops of the Michigan Central, Detroit, Mich.

a capacity sufficient to contain the moisture drained from the coils for a period of from eight to ten hours.

There are undoubtedly other arrangements which could have been used to as good advantage. However, the choice of any arrangement depends upon the conditions present. The question of utilizing the available heat from the compressed air is a matter dependent upon the continuity of operation, but as the demand for compressed air is somewhat variable, and the compressor is generally controlled automatically, it would appear that to depend upon a continuous source of heat would be taking unwarranted chances.

Should the limitations of space prohibit such an installation as this, it might be advantageous to use smaller coils and provide a fan for the circulation of cooling air, thus obtaining better and more positive results. With a positive circulation, it would also be somewhat easier to predict the results that could be obtained.

THE AVERAGE COST per ton of coal used as fuel for road locomotives in freight and passenger train service for Class I roads in July was $2.68, as compared with $2.98 in July last year, and for the seven months of 1925, including July, the average was $2.77 as compared with $3.15 last year, according to the monthly bulletin of fuel costs compiled by the Interstate Commerce Commission. This covers only fuel charged to operating expenses and does not include switching and terminal companies or fuel for switching locomotives. While the cost of coal shows a reduction the average cost of fuel oil per gallon increased, from 2.89 to 3.33 cents for July and from 2.75 to 3.18 cents for the seven months period. The total cost of coal and fuel oil for July was $25,285,608, as compared with $25,785,903 for July, 1924, and the total for seven months was $188,403,445, as compared with $211,374,783 last year.

Needle valve reseating tool

By Glenn L. Davis

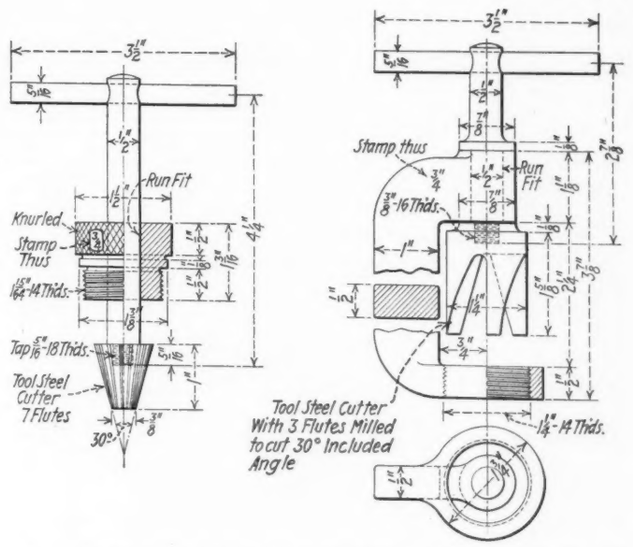
WHERE the locomotive shop toolroom was formerly considered as merely an added overhead burden—a necessary evil—it is now looked to as the originator of time-saving devices and methods and it is worthy of note that, in general, toolroom foremen are measuring up to their new responsibilities and heartily co-operating with tool designers in producing jigs, fixtures and small tools of greater perfection. An example of improvement in railway tool design is shown in the accompanying illustrations.

Needle valves controlling the flow of oil to oil burners of various types, require maintenance of the highest quality to prevent serious leakage losses and leakage dangers. The tool shown in Fig. 1, reseats the valve seat and mills the end of the needle stem to produce an oil-tight joint.

The tool is made in two sizes for ½-in. and ¾-in. needle valves and it is believed, represents a distinct advance over the older method of using a reseating reamer similar to the one shown and, refinishing the needle stem in an engine lathe, or by means of a hollow mill driven in various machine tools. The primary consideration in designing tools of this class is to produce a compact, light, pocket tool so adaptable that it will do away with costly "stripping" to get at the repair job and the more costly replacing of the dismantled piping after the valves are repaired.

Fig. 2 shows the seat reamer removed from the frame. The knurled and threaded nut on the stem of the reamer fits into the threaded bonnet cavity of the valve body when the bonnet is removed and hand pressure on the reamer handle is sufficient for the slight feeding necessary in reaming the average seat. Since the thread on the bonnet of the valve matches the thread on the centering nut of the reamer it is obvious that, with the reamer removed from the tool frame, the valve bonnet, with the valve stem in place in the bonnet, can be screwed into the tool frame in place of the reamer and in this position the stem can be brought up against the hollow mill and refinished.

Fig. 3, which shows the tool completely disassembled, shows how the mill is held against end movement. Since no feeding movement of the milling cutter is possible with this arrangement, it is necessary to feed the valve stem to the work and this is accomplished by screwing the valve stem down through the internally threaded bonnet just as in closing a valve.



A tool which reseats the valve seat and mills the end of the needle stem to produce an oil-tight joint

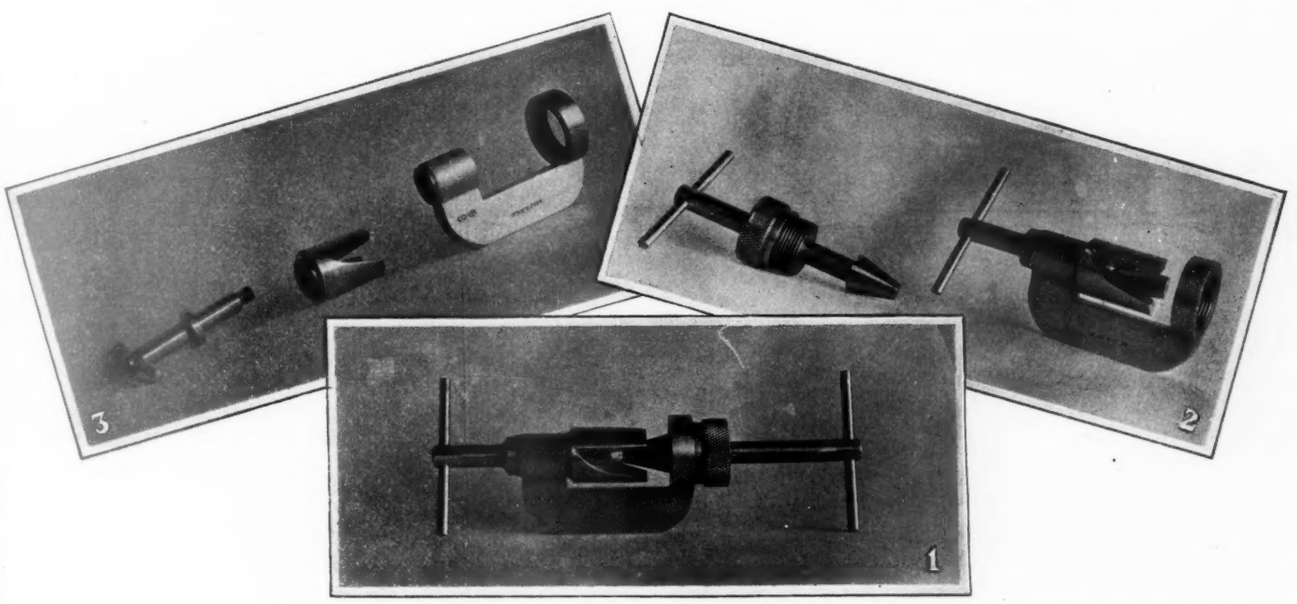


Fig. 1—Reseating tool completely assembled; Fig. 2—Seat reamer removed from the frame; Fig. 3—Tool completely disassembled

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THE PENNSYLVANIA is equipping its dining cars with aluminum chairs, to be made by the Aluminum Company of America, Pittsburgh, Pa. The road aims to eliminate all fire hazards. The chairs will be so upholstered as to harmonize with the decorations. The Pennsylvania at the present time is operating 139 all-steel dining cars, and 10 new cars are under construction.

An inexpensive acid container

By Frank Bentley

A PRACTICAL container for the muriatic acid used to clean scale from injector and other small feed water parts is shown in the illustration. The receptacle is the lower half of a paint or oil barrel, the wood of which being thoroughly oil soaked resists the action of the acid for a long time. The cover of ¼-in. sheet iron is cut with four lugs to keep it securely in place over the top of the container. Together with its weight and ability to shed water, it is a safe and suitable covering. To a convenient depth, the half barrel holds the entire contents of one standard carboy of acid. When eaten out, the renewal of the barrel is a matter of but little time and expense.

Acid container used for cleaning the scale from injectors and other small feed water parts

Driving box calipers for use in limited spaces

By L. V. Mallory

Machine shop foreman, Missouri Pacific, Kansas City, Mo.

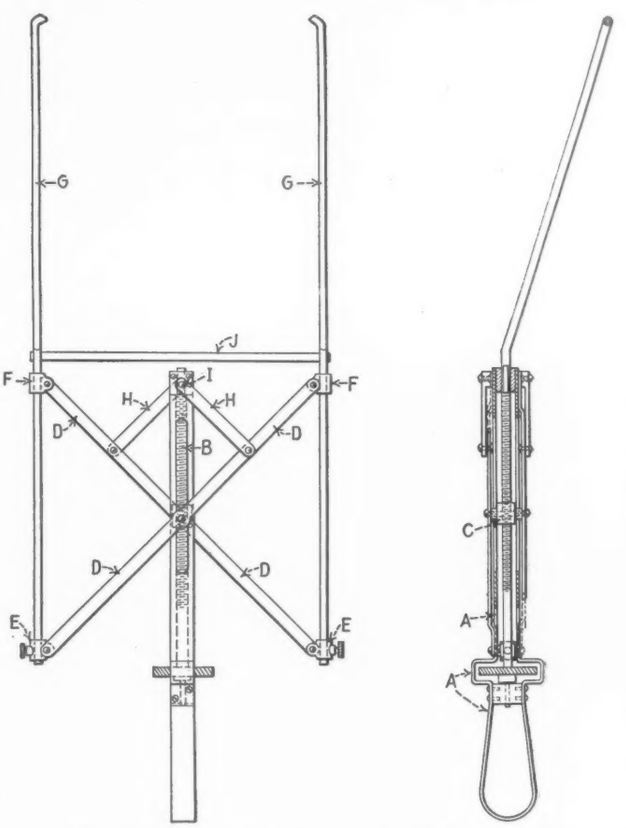
WHERE locomotives equipped with driving boxes of the removable brass type are used, it often becomes necessary to measure the journal diameter and the bore of the crown-brass seat in the box casting when fitting a new brass. This usually must be done without removing the box which leaves a limited space between the journal and the box casting that can not be measured accurately with ordinary calipers. A practical tool for making these measurements is shown in the illustration.

The frame *A*, made of ⅛ in. by ⅝ in. scrap steel, is braced by two small, brass, spacer blocks which also serve as the bearings for the adjusting screw spindles. The adjusting screw *B* is made of ¼ in. round steel which has cut on it standard threads, 20 to the inch. It has mounted on its lower end, a small knurled wheel which is housed in the handle in such a manner that it can be conveniently operated by the thumb. This screw engages the pivot block *C* which is threaded to receive it. The pivot block has a trunnion on each side that extends through slots cut in the frame *A*. Pivoted centrally to these trunnions are the cross-levers *D*, the lower ends of which are hinged to the stationary connecting knuckles *E*, while the upper ends are hinged to the sliding connecting knuckles *F*.

The caliper bars *G* slide through the knuckles *F* with the lower ends rigidly secured in the knuckles *E* by means of knurled, headed thumb screws. These bars are made from 5/16 in. drill rods with the upper ends bent at right angles to form the calipering points. The drawing shows the bars bent, also, just above the sliding knuckles which provides clearance between the axle and the handle and frame.

The upper ends of the two connecting toggle levers *H* are pivoted to the frame while the lower ends are pivoted to the cross-levers *D* at points midway between their upper ends and central pivots.

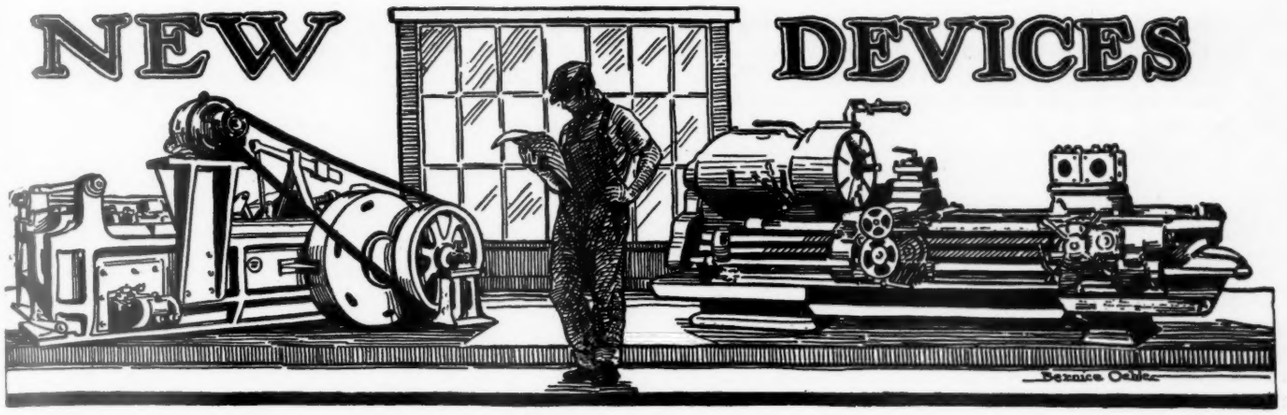
The principle on which the tool works is as follows: The adjusting screw *B* when turned, moves the pivot block *C* vertically between the frame and also moves the levers *D* because the pivot block forms the fulcrum of these levers. Since the connecting toggle levers *H* are hinged to the frame and the free ends connected to the cross-levers *D*, it is obvious that any change in the relative position of the pivot *C* and the fulcrum *I* of the toggle levers will cause them either to close or open the levers *D* according to the direction in which the screw *B* is turned. This action causes the knuckles *E* and *F* to act on the caliper bars G, thus opening or closing them in parallel lines.



Close quarter caliper for use in limited spaces

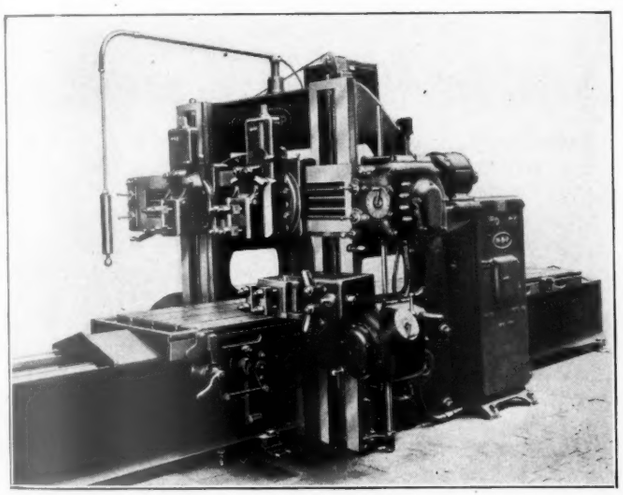
When used for calipering journals, the points face each other. When it is desired to use them as inside calipers for measuring the bore of the seat in the box-casting, the thumb screws attached to *E* are released and the bars *G* are turned half-way round so that the points face away from each other, after which they are firmly secured. A strong, rubber band *J* may be used to take up and lost motion which may occur in the joints.

This tool also can be used to advantage in calipering crank pins and rods when fitting floating bushings.



Planer with unique system of control

A NEW line of planers to be known as the Timesaver model has recently been placed on the market by the Niles-Bement-Pond Company, New York. This model is practically a new design throughout. In developing these machines every effort has been made to



Niles-Bement-Pond Timesaver planer

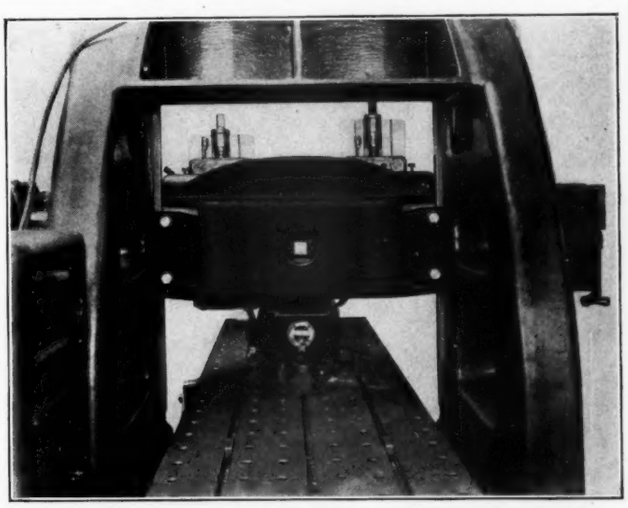
meet all modern requirements as to ease and convenience of operation, rapidity of control, safe operation and ample strength and power. An important point bearing on maintenance costs is the decided simplification of construction, many small parts formerly associated with planer design having been eliminated. This new model is furnished in 36-in., 42-in. and 48-in. sizes.

Among the new and interesting features are electric feed and traverse for both crossrail and side heads; complete control from a pendant switch of all movements of the tool heads, crossrail and table. Another important feature in speeding up work is a duplication of control that gives the workman complete control of all important operations from either side of the machine.

In order to make the planer as easy and convenient as possible to operate and to greatly simplify construction, a motor is mounted at the end of the crossrail to feed the crossrail and side heads, to provide power traverse to all heads and to elevate and lower the crossrail. This motor is controlled by the pendant switch and the table dogs.

The direction of motion for either feed or traverse is determined by four-position levers at the end of the crossrail, one for each crossrail head. The levers are thrown in the direction in which the motion is desired. The feed and traverse motor is controlled by the pendant switch and the amount of traverse can be controlled either by the switch or by the levers. Another lever at the end of the crossrail engages the elevating and lowering of the crossrail.

As there are many times when it is a decided advantage to be able to control the machine from either side, an important feature is the duplication of all control levers. From whichever side of the machine is most convenient the operator has complete control of the traverse and automatic feed of the tool heads, the crossrail clamping and elevating and lowering as well as control of the table motion. The pendant switch can be pulled from one side



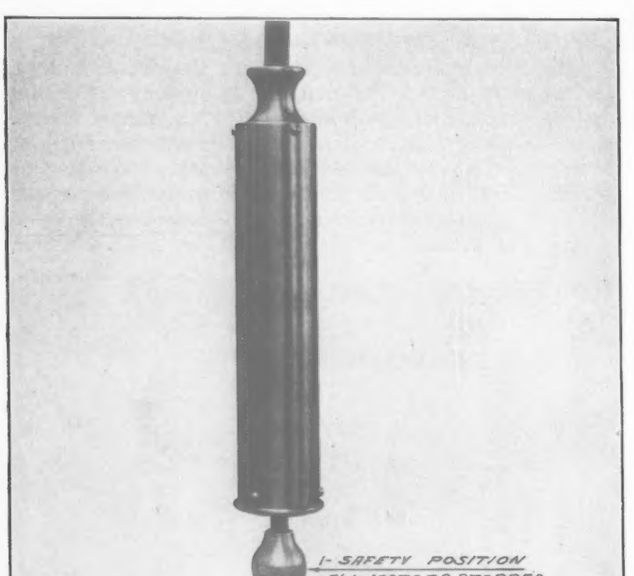
Rear view showing the cross-rail clamping mechanism—A stiffening web on the top of the rail is provided to resist the torsional strains

of the machine to the other. The knob on the pendant switch has four positions, as is shown in one of the illustrations; in the upper or safety position all motion is stopped; in the second position down, the driving motor is controlled for setting the table with the work in the desired position relative to the tools; in the third position down by turning the knob back and forth the traverse of

the heads and tool slides is controlled and tool can be set to the exact required position; in this position the elevating and lowering of the crossrail is also controlled. In the fourth position the table is started and the automatic feed engaged.

Perhaps the greatest step toward simplification on these planers is the electric feed. Ordinarily in the past, on planers of this size, the common practice has been to take the power for feeding the heads from the driving gears in the bed. This has, of course, made it necessary to connect the driving gears in the bed with the feed mechanism at the end of the rail and in the side heads through various gears, shafts and brackets. On the new planers, with electric feed through the motor on the end of the rail a great deal of mechanism has been eliminated. The usual "spring ratchet click boxes" with their troublesome springs and ratchets have been replaced by four-position levers.

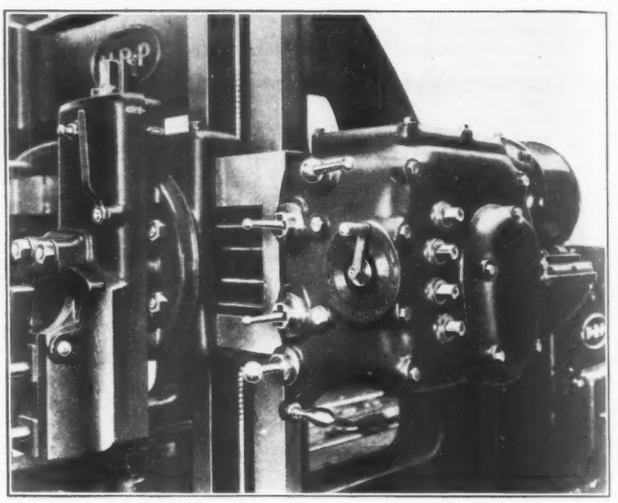
Another advantage of this electric feed is that the maximum feed can be obtained even on the shortest stroke. This results from the fact that with the electric feed the amount of feed possible is not in any way proportional to the length of stroke as is the case with the old type of feed box driven from the driving gears in the bed. By means of a switch the electric feed can be set to take place at either end of the table stroke. The feed is absolutely positive, there being no frictions or springs to get out of order. The selection of the amount of feed



Pendant switch showing the different control positions

is by direct reading dials conveniently located on the crossrail and side head; the side head feed is independent. The minimum feed is 1/16 in. and increases by sixty-fourths to 1 in.

Another time saving feature is the single lever crossrail clamp, so designed as to give an extremely powerful clamping action with an easy effort on the part of the operator. There is a lever at each end of the crossrail so that the crossrail can be clamped from either side of the machine. The operating levers are connected by a shaft running across the rail. A cam keyed to the middle of this shaft bears against a steel plate, as shown in the illustration, which is moved in and out as the operating lever is moved. The steel plate transfers the clamping force to the ends of the clamping levers which have fulcrums at the large bolts shown and bear against the housings thus rigidly clamping the crossrail. The difference between the clamp fit and the sliding fit between the crossrail and the housing is a matter of .0015 in. The clamping effort on the housings is therefore roughly in proportion to the ratio between .0015 in. and the distance



Micrometer collars, compact control levers, electric feed and traverse gear box and motor shown at the end of the cross rail

moved by the hand lever, a ratio which gives a tremendous leverage and therefore an extremely powerful clamping action.

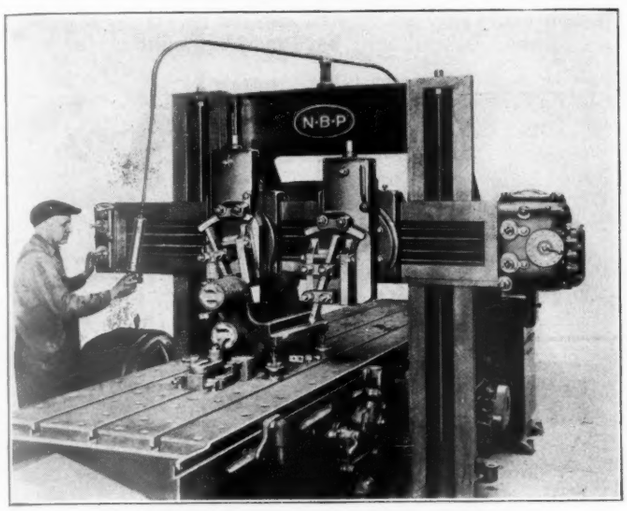
Every effort has been made to make the machine foolproof. The pendant switch is electrically interlocked with the rocker lever at the side of the bed so that when the pendant switch is pushed to the upper position to stop the table the rocker lever is made inoperative so that the table cannot be accidentally started by knocking against the rocker. An electrical interlock also makes it impossible to traverse the heads while the table is in motion and vice versa.

A safety coupling has been provided between the machine and the motor on the rail. This coupling is constructed so as to prevent damage to the machine if the operator traverses or feeds the crossrail heads together, if he traverses or feeds the side heads up against the crossrail, or if he lowers or elevates the crossrail against any obstruction. Again, the clamping levers for the crossrail are interlocked with the elevating levers so that it is impossible to throw in the elevating and lowering lever while the rail is clamped and vice versa.

The side head is designed so that the side head tool may be brought up close to the crossrail tool without any overhang on the crossrail tool slide. In order to do this, the side head is offset; that is, the feeding and traversing driving mechanism are kept below the head. The side head tool has also been brought up in line with the rail head tool. Where this is not done, the table stroke for any job requiring the side head will ordinarily have to be increased a distance equal to the horizontal distance between the tools.

The same gears are used for traversing and feeding the heads and elevating the crossrail and are all contained in

the gear box at the end of the crossrail which is filled with oil. Two large gears driving the small gears on each rod and screw are constructed so that they dip under the oil level and flood the entire box with oil. As an additional precaution, a single shot lubricator has been provided.



Here the operator is shown selecting the direction of motion of the back rail head with his left hand and controlling the amount of motion by turning the pendant switch knob with his right hand

The driving gears in the bed and the table rack are all made of steel and are of the Maag type. They run in oil and in addition, have oil pumped through directly to them. Holes have been drilled down the center of the driving gear shafts with connecting holes to the bronze bushings so that oil is pumped directly to the gear bearings. An oil pump is driven from the driving gears in the bed for furnishing forced lubrication to the table ways. Oil grooves have been planed in the table so that the oil is distributed evenly over the entire bearing surface. A single oil cup has been placed on each side of the heads for lubricating all of the various sliding members.

The gear box at the end of the rail is split so that by removing the bolts in the top cover, it may be removed and all the parts in the gear box are quickly opened for inspection.

The crossrail has been designed to resist the upward bending movement by providing a stiffening web on the top of the rail, and to resist the torsional strains and backward bending movement by making the crossrail deep. This, together with the crossrail gibs on the outside of the housings, and the clamping gibs on the inside, give the crossrail the necessary stiffness. The crossrail heads are offset so as to permit the tools in the heads to be brought as close together as possible.

The tool slides are wide and of full length so as to give the necessary stiffness even while the slide is extended down below the crossrail. The saddle is one solid piece extending around and bearing against the back of the crossrail so as to rigidly resist the cutting pressure at the bottom of the slide.

The bed is twice the length of the table so that the latter never overhangs the bed. Also, no part of the machine is below the floor line.

Boring mill designed for convenient operation

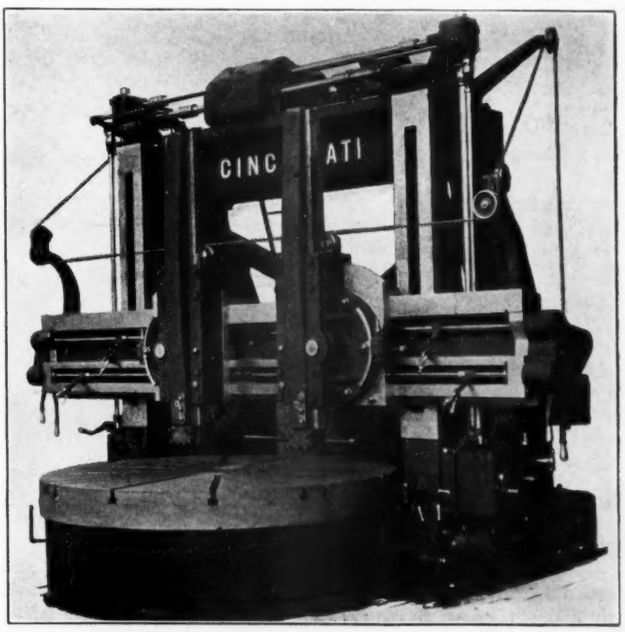
THE Cincinnati Planer Company, Cincinnati, Ohio, has placed on the market an 8-ft. boring mill which it is said can be handled as easily and quickly as a mill of much smaller capacity without sacrificing rigidity in any part of the machine. Convenience for the operator, simplicity of design, elimination of wearing parts, and fool-proof arrangements to eliminate all liability of breakage, is shown in the centralized arrangements of all control levers and the operation of the rail lift, rapid power traverse to the heads, centralized oil distributors, etc.

Rapid power traverse to the heads vertically and horizontally is so arranged that by one movement of the operating lever the feeds are disengaged and rapid motion is imparted in the direction indicated by the movement of the lever. When this lever is brought back to a neutral position the rapid power traverse is disengaged and the feed engaged once more. The new design of this mechanism has eliminated all constantly revolving parts with the exception of the motor and one shaft on top of the machine. Safety features are incorporated throughout.

By rapid power traverse the heads are placed at approximately the position desired. Quick adjustment handles are provided for the final setting of the tool. With these the heads can be moved accurately any number of thousandths of an inch without the operator going to the end of the rail. Graduated collars are provided on both feeds for making these final adjustments. Feed changes to both heads are obtained on feed boxes located conveniently for the operator. They have direct reading feeds in inches per revolution of the table.

The rail is elevated and lowered through an instantaneous rail lift mechanism which is positively interlocked with the rapid power traverse and which has an automatic stop for the maximum height of the rail.

On boring mills of this size it has always been custom-



The table speeds of the Cincinnati 8-ft. boring mill can be changed from the front of the machine

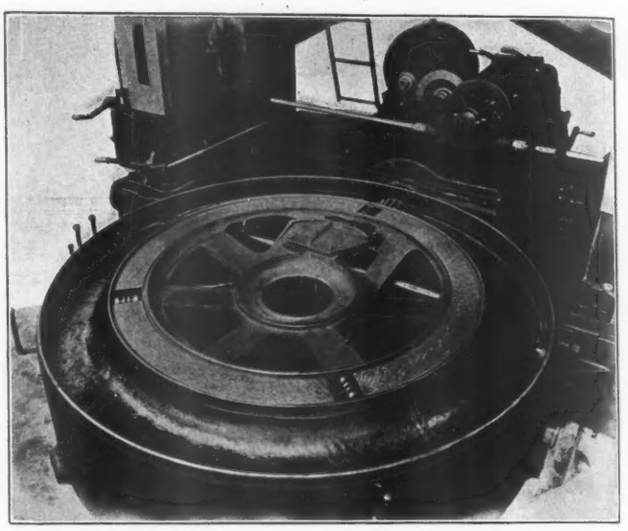
ary for the operator to go to the rear of the machine when changing table speeds through positive gears or clutches. This machine is arranged so that the positive changes in the main gear box are made from the operator's position in front of the machine. To further assist him in setting up work on the table a start and stop lever is used by means of which the table can be revolved any part of a revolution at the will of the operator. This lever operates through a clutch and brake on a high speed shaft in the driving mechanism. When a mill is driven by alternating current motor this feature is of great importance.

The speed gear box is so designed that it acts as a tie between the housing extensions giving additional rigidity to the base of the machine. All driving gears in this box are of steel and all speed changes are through positive clutches. The back gear shaft of this box extends through the front and receives a third bearing in the bed proper. The table pinion shaft also extends from the bed and receives a third bearing in the speed box. All bearings are of bronze and have ample facilities for oiling. All shafts not extending through the box are covered with oil and dirt tight caps.

The design of the bed is a decided departure from the accepted standard. The table bearing has been brought more nearly under the normal position of the load, thus lessening the tendency to spring the table. Heavy radial ribs are used and, as they are shorter are much more rigid. A ground spindle is pressed into the table, running in an adjustable bearing in the bed to compensate for wear.

Heavy housings with wide faces are used, these being mounted securely on large box extensions bolted to the bed and tied together at the back by the speed box. A box type arch ties the housings together at the top. This construction increases the rigidity of the machine when working at any height from the table as it gives sufficient depth to the housings to resist the pressure and bending movement from the tools. The rigidity is also increased by the use of diagonal braces which tie the housings together at the back.

All gears, including those operating the table drive, rapid power traverse and feed, are of steel, the table pinion being of heat treated chrome nickel. All bearings are bronze bushed and have ample facilities for oiling.



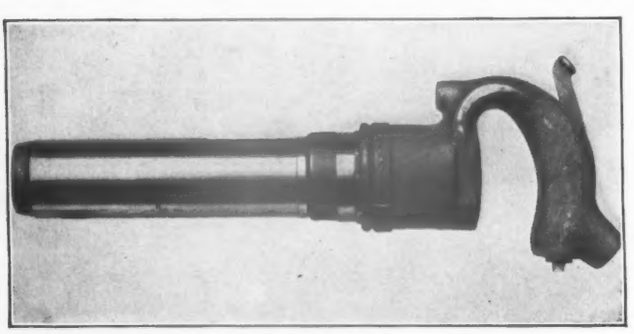
Cincinnati boring mill with the table removed showing the rigid construction of the bed—Note the construction of the gear box at the rear of the table

Oil cups and oilers have been displaced wherever possible by the use of centralized oil distributors which require filling only once in ten days. These distributors are used for all revolving bearings in both feed boxes and all mechanism on top of the rail.

Thor pneumatic riveting hammer

A PNEUMATIC hammer, known as the Thor riveting hammer, and embodying several important improvements, has been developed and placed on the market recently by the Independent Pneumatic Tool Company, Chicago.

The handle of this hammer is drop forged to shape from special alloy steel, particular care having been taken to leave plenty of stock at the bend and at the nipple lug. The handle opening has sufficient room for a large gloved hand and is shaped for a natural grip. The trigger is designed to have correct tension and is located to fit the hand grip. The throttle valve of this hammer is self-feeding, of the balanced type with spiral openings insuring accurate graduation for starting and control. The throttle valve stem, of hardened steel, operates in a bronze bushing. The handle is screwed on the barrel, large V-threads being used and the thread connection is exceptionally long. The handle lock is of the positive ratchet type held by an octagon milled on the barrel. The octagon gives eight positions for each tooth so the teeth always mesh tightly.



New Thor riveting hammer of improved design

The main valve is a hollow substantial sleeve without any portholes. The walls are of even thickness. The inside of the lower end of the valve is ground with a slight taper, eliminating danger of the piston striking the valve squarely. The valve has large and long surfaces, insuring long life, precision of timing and high speed. The exhaust and inlet are widely separated, thus tending to prevent leakage and loss of power. The valve is hardened and ground all over.

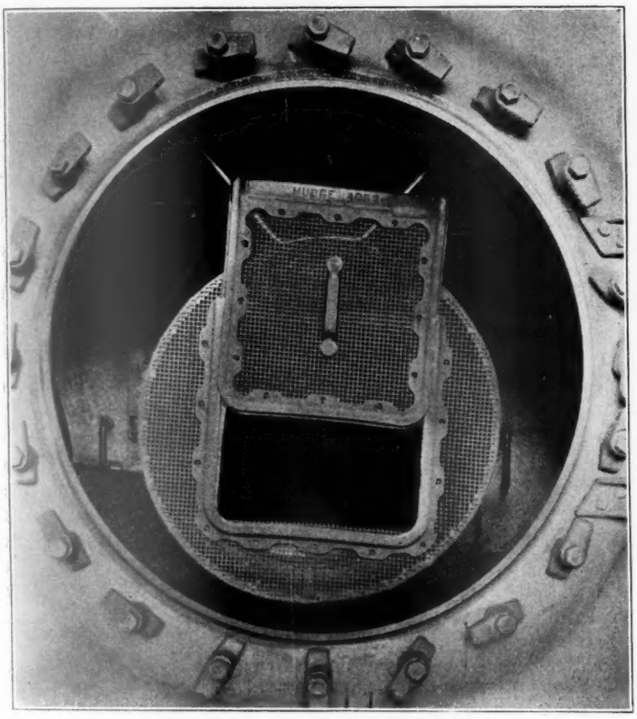
The valve block also is hardened and ground all over, portholes being laid out in straight lines, assuring direct passage of the air in its natural flow and eliminating any effect of wire drawing. The barrel is of alloy steel, heat treated, with the piston bore hardened, ground and lapped. The nozzle bore is hardened and ground. The exhaust at the upper end of the barrel is diverted at any angle which may be desired by the operator by turning a de-

flector. The throttle is designed with a special view to secure it in a certain position so that it will always stay tight while in service.

The hammer is symmetrical in shape, devoid of any projections or irregularities, and carefully balanced like the Thor chipping hammer. It is designed to have accurate regulation, delivering exceptionally rapid and powerful blows with no back kick.

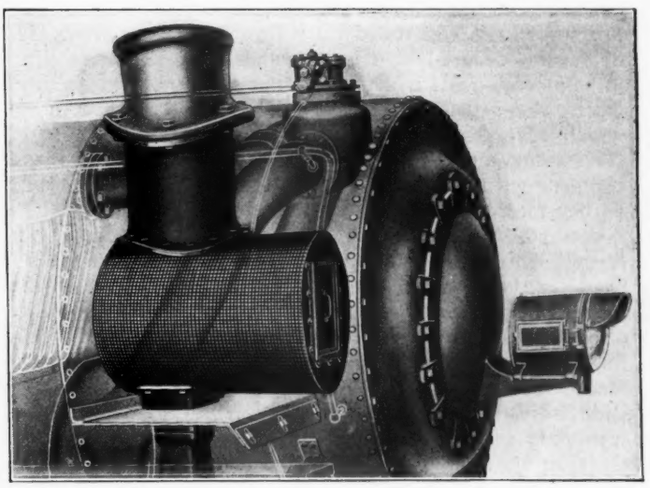
Security unit locomotive spark arrester

A DEVICE designed to prevent the emission of sparks from locomotives and reduce the cost of front-end inspection and maintenance work has been placed on the market recently by Mudge & Company, Chicago. It is called the Mudge security unit locomotive spark arrester. Special features of the design are the increased netting area which permits a larger exhaust nozzle, thereby reducing back pressure, possibility of complete inspection without removal, easy removal and reapplication when necessary, and the elimination of patching joints, always a potential source of trouble in a locomotive front end.



Front view showing spark arrester as applied to one of the three-cylinder locomotives built within recent months

The new spark arrester, shown in the illustration, is built as a unit, welded together and bolted to an angle iron frame apart from the front-end. It is installed through the smokebox front door as a unit without difficulty. The general construction of the spark arrester is evident from the illustration. It is built in the shape of a cylinder small enough to pass through the front-end door. The front and rear ends and seam of the spark arrester are reinforced by suitable angles bolted to the netting. The bottom of the arrester is bolted through a liner to the saddle casting, the top being bolted with a liner to the stack extension.



Phantom view, showing construction and application of Mudge security unit spark arrester

All patching of joints is eliminated in the Mudge curity unit spark arrester as it is entirely independent of any other part of the front-end. There is no interference with superheater or front-end throttle and it permits of complete front-end inspection without removal.

Open-side planer with rigid cross rail

THERE are many classes of work for which the greater convenience of the open-side planer is conceded. But some users of planers have been reluctant to buy machines of this type, fearing that it is impossible to secure the necessary degree of rigidity with the cross rail supported only at one end. In the open-side planer, which the Liberty Machine Tool Company, Hamilton, Ohio, is now building, there are numerous features that commend it to favorable consideration. Among these the question of a high degree of rigidity for the cross rail support has received especial attention with a view to overcoming the possible prejudice of those who would like to use open-side machines for handling jobs that cannot conveniently be set up on a planer with two housings. That this effect has been successful is well attested by the fact that under test on cast iron, with a cut 1½-in. deep and a feed of ¼-in., the maximum deflection at the outer end of the rail was found to be only .0035 in.

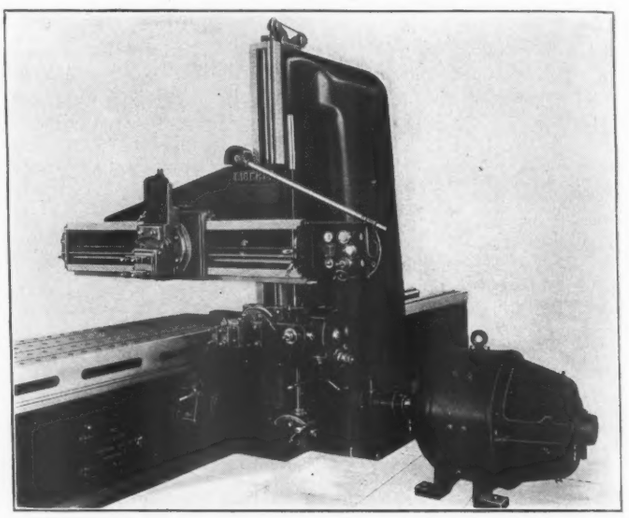
This degree of rigidity is attained through the provision of an unusually massive knee on which the cross rail is mounted. This knee hangs on liberally proportioned bearings on the column and is furnished with an arrangement of gibs for positively locking the knee in any desired position, which is accomplished by a hand crank on a shaft which transmits motion through two pairs of bevel gears

to a vertical screw connected with a taper gib. Turning of the hand wheel pulls this gib up and affords liberal locking power through the combined multiplying action of the screw and the wedge.

On page 122 in the February, 1925, issue of the *Railway Mechanical Engineer*, appears a description of a Liberty planer of the double-housing type. The present open-side planer includes all of the important features which have been incorporated in this machine. One motor is employed for driving the table while independent motors are furnished for the rail and the side head. This arrangement eliminates all overhead work and makes the cross rail and the side head fully independent units, capable of employing any feed or rapid traverse movement.

Elevating or lowering the cross rail and also the power rapid traverse of the rail head vertically and horizontally, are accomplished by manipulating a single lever. With this arrangement it is impossible to engage two different movements simultaneously, thus furnishing a fool-proof control for the rail. Feeding the head vertically and horizontally is controlled by a lever and the desired rate of feed is secured by turning a small hand wheel which is connected with a dial that shows the rate of feed for which the setting has been made. The electric motor, which furnishes these movements, is of 1½-hp. and receives current through a protected trolley that makes contacts with conducting strips fastened to the housing. Either alternating or direct current can be used and, if necessary, it may be taken from a lamp socket. The screws which move the head on the cross rail and the side head on the housing are held stationary and in tension, movement of the heads being accomplished by the rotation of a nut on the screw. A lever is provided for controlling the horizontal feed of the head on the rail or the vertical feed of the tool slide. This vertical movement of the tool slide is also accomplished by revolving a nut around a stationary screw held in tension. Similarly, the screw for elevating and lowering the cross rail is held stationary and in tension. A vertical shaft is employed for transmitting power to the feed mechanism of both the rail head and side head. The transmission gears are so arranged that throwing a lever into two different positions enables the feed to be accomplished either at the end of one cut or just before starting a new cut.

All of the mechanism at the end of the cross rail, that for controlling the feed and power rapid traverse of the side head, and the feed reversing mechanism at the bottom of the housing run in oil. Gages indicate the level of the oil at these points. The housing extends down to the floor and is attached to the bed by means of bolts, fitted into reamed holes. Additional heavy dowel pins eliminate any movement between the housing and the bed. Provision is made for forced feed lubrication, the pump and control valve of this system being located on the outside of the

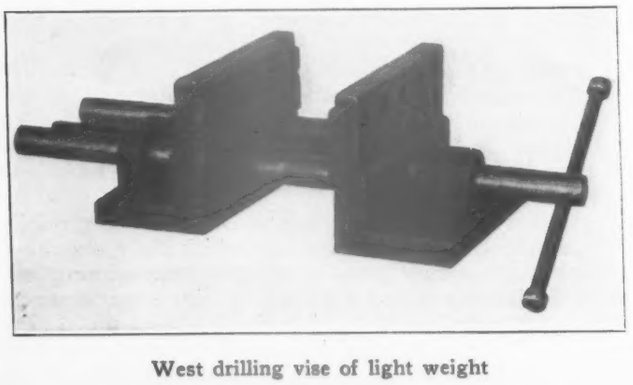


Liberty open side planer showing compact arrangement of the control levers

housing. In addition, there is a sight feed attachment which enables the operator to see whether the system is functioning properly. All oil entering the bearings is filtered through a sequence of filtering stations in the bed and then passes through a ½-in. felt wick. The planer bed is twice the length of the table so that the latter never extends beyond the ends. A balanced drive is secured through the use of herringbone gears which eliminate friction and side thrust. These gears are contained in a box cast into the bed to provide for running the gears in a bath of oil.

A convenient drilling vise

THE D. S. West drilling vise, designed to lighten the work of the machinist, has been placed on the market by the Armstrong Manufacturing Company, Portland, Oregon. The advantages claimed for this vise are its light weight, which is only about one-half that of the ordinary drilling vise; the fact that either jaw forms its own base and may be clamped to the drill press table the other jaw remaining movable, and its ability to hold irregular shapes in almost any conceivable position for drilling.



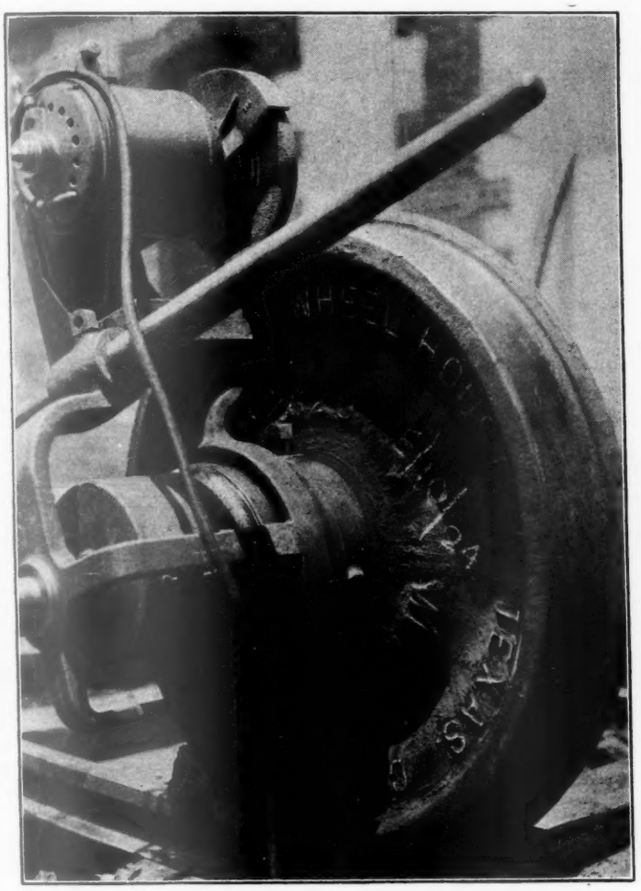
West drilling vise of light weight

The notches machined at the top of the inner edges of the jaws form a rigid support for all kinds of flat and square material, holding such material in a level position so that drilling, tapping or milling may be accomplished. Vertical and horizontal V-grooves are provided for holding round material. Cross rods in combination with the ledges form a base for holding circular, and irregular shapes at any angle for drilling, the cross rods taking the thrust of the drill.

Another feature of the vise is that each jaw is its own base. Either jaw may be clamped down and the unclamped jaw will slide on the drill table. The vise will hold any irregular-shape piece rigidly and will not twist the drill. It is not necessary to block under the work as is the case with many vises.

Castillo portable car wheel grinder

A PORTABLE grinding device has been developed recently for removing the flat spots from car wheels and is being marketed by E. H. Batchelder, Lytton building, Chicago. One of these machines is being used by the Rock Island, one by the Burlington, and five are said to have been in service on the National Railways of Mexico for the past three years reclaiming slid flat wheels with satisfactory results. The machine, which is simple in construction and operation, has the effect of prolonging the life of car wheels. It is driven by a one-horsepower electric motor, weighs about 300 lb., and can be operated by one man. The relatively small weight and cost of this machine, make it especially adaptable to use at rip tracks where the limited number of wheels handled would not justify installing a heavy stationary grinder.



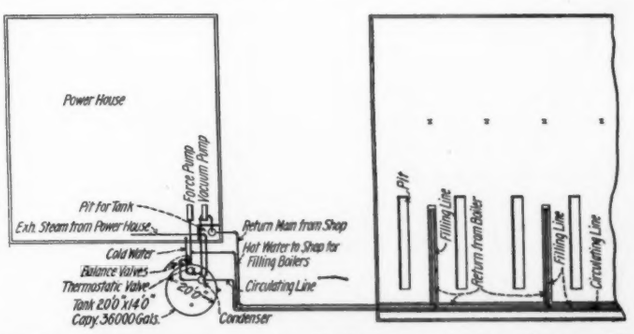
Castillo portable wheel grinder

Referring to the illustration, the construction of the grinder will be evident. The abrasive wheel, driven by special electric motor, is mounted on a cast steel frame capable of a reciprocating, rotary motion about a housing, located centrally with regard to the axle journal and securely fastened to it by set screws. The center of oscillation of the abrasive wheel and steel frame is slightly below the actual center of the axle so that the abrasive wheel moves on an arc larger in radius than that of the car wheel circumference. The effect of the grinder is therefore to spread the flat spot over an arc from 14 in. to 20 in. long depending on the length and depth of the flat spot. The abrasive wheel has lateral movement across the wheel tread by slippage of the cast steel frame on the housing, and radial movement by a feed screw. The tread taper is taken care of by hand adjustment of the feed screw.

Reference to this machine installed on the Rock Island was made at the Mechanical Division proceedings in June, it being stated that 12 pairs of wheels were ground with the machine in 251 min., or an average of 21 min. per wheel, and at a cost of 40 cents per wheel, which did not include the electric current or shop pro rata. The flat spots varied in length between 2½ in. and 3 in. and the metal removed ranged from 3/64 in. to 1/16 in. deep. All of the wheels thus ground were restored to service on the Rock Island equipment and have given satisfactory service since. A careful check of their concentricity indicated that they were not more out of round than is found to be the case with the great majority of new wheels.

Locomotive hot water hydrostatic testing plant

THE accompanying illustration shows a hot water testing plant for back shops or boiler shops where a number of locomotive boilers are tested daily. This work is generally done by filling the boiler with a hot water injector which takes live steam and a good deal of it. One boiler is often tested several times making a large waste of hot water, and as this water runs into a pit it produces a great deal of vapor in the shop. The plant shown has a large receiving and supply tank and a high pressure pump on the discharge line. The discharge line is run below the floor with a connection to each pit. At the far end of the discharge line a circulating line returns to the tank. The pump moves constantly, just enough to keep up the circulation. As soon as the locomotive boiler is connected to the main and the valve is opened, the pump goes to work and will flow any amount required, usually between 300 and 400 gallons per minute so that the boiler is rapidly filled with water at a predetermined temperature. The pump may be so set that it will furnish the required pressure and when it gets to that point it will slow down, or the boiler can be filled and the pressure put on with a hand pump. As soon as the defects have



Piping arrangement of the National automatic, hot water hydrostatic testing plant for locomotives

been chalked the boiler is disconnected from the discharge line and connected to the return line through which the boiler is emptied.

The return line is also below the floor with a connection to each pit. Near the far end it runs through a small regulating tank and from there through a vacuum pump to the main reservoir. The pump is governed by an outfloat on the regulating tank. When a boiler is connected this tank fills up and, through the float, opens the steam line to the pump. When the boiler is empty the pump lowers the water in the regulating tank and shuts off the steam, stopping the pump. The whole arrangement is automatic. A supply of hot water at a fixed temperature is always available. The temperature of the main tank and the height of the water is automatically governed.

This equipment is built by the National Boiler Washing Company, Chicago.

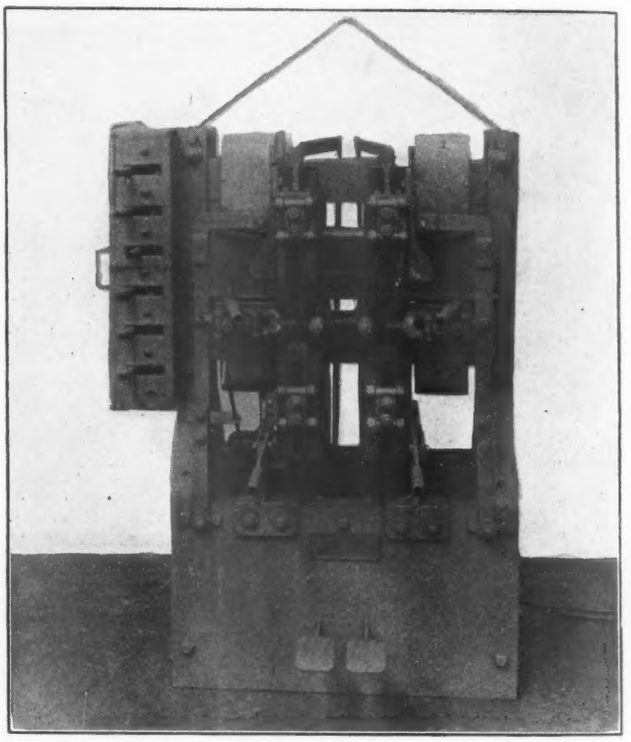
Electric rivet heater for the boiler shop

THREE models of electric rivet heaters, all of which operate on alternating current of any voltage, have been placed on the market by the American Hoist & Derrick Company, St. Paul, Minn. Model A is a two-rivet machine with a 40-ft. superservice table, and weighs approximately 1,100 lb. Model B is a four-rivet stationary type which weighs approximately 1,900 lb. These models are primarily designed for heating rivets for structural work. Model C is a two-rivet machine, especially designed for heating rivets for boiler work. It weighs, ready for service, approximately 2,500 lb.

Model C is equipped with special adjustable side contacts so arranged that the temperature in any part of the rivet may be regulated by the operator. This arrangement enables the operator to heat the grip of the rivet to a white heat, while the end and head are kept at the proper temperature for driving, thus insuring that the rivet completely fills the holes.

The sliding jaws and the E element are of solid cast copper throughout and have thirty times the current carrying capacity of a 1-in. rivet, making it impossible to overheat the machine to a dangerous degree. They are so designed that the rivets up to and including 9 in. in length can be placed in the jaws without any adjustment and with no fear of mushrooming. The sliding jaw permits the E element to be constructed in such a manner as to tightly hug the laminated iron case—its source of power—on three sides, thus practically eliminating magnetic losses and reducing current consumption to a minimum.

All three types are equipped with interlocking heat control, conveniently located at the operator's left hand, which provides instant control of the current. This feature is essential for the proper heating of rivets.



Two-rivet electric rivet heater for the boiler shop

Multiple recording pyrometer

A RECORDING pyrometer which combines accuracy, with other desirable features, has been developed by the Brown Instrument Company, Philadelphia, Pa. The recorder has a die cast black enameled aluminum case. The dimensions are 15 in. high, 14 in. wide and 9 in. deep, requiring a minimum amount of wall space when using a chart 7 in. wide. The instrument is built to make a single record, a duplex record with two records side by side, or in multiple form produces as many as 12 records on one chart.

It operates on the frictionless principle in which a pointer swings freely and at intervals of every 30 sec. is depressed on a carbon or inked ribbon producing a mark on the chart. These marks are so close together as to form a continuous line. The marking ribbon and chart last two months before renewal is required and no inking is necessary. The marking ribbon is above the paper so that the mark is produced on the front side of the paper where it shows clearly. The marking ribbon in the single and duplex recorder, after each mark on the chart, is moved back disclosing the last impression so that the record is clearly visible immediately after it is produced.

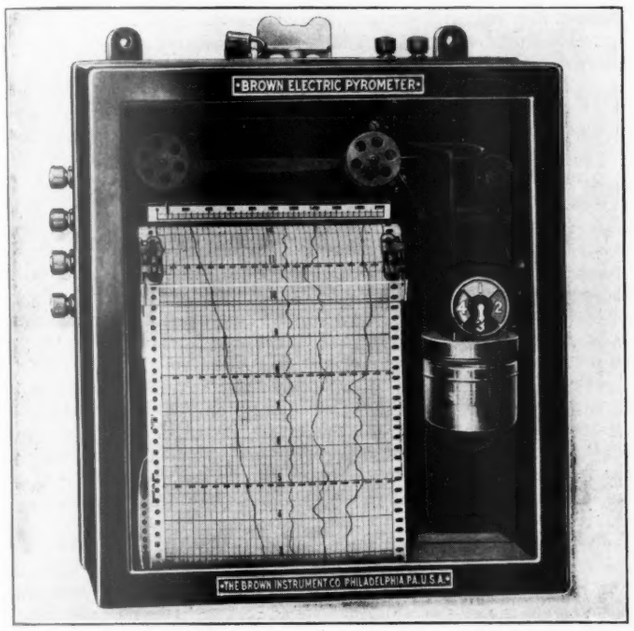
A glass knife edge for tearing off the paper is located directly below the driving roll. The paper can be torn off two hours after the last impression is made.

The galvanometer and the recording chart mechanism is carried on a hinged frame. When swung aside, the galvanometer is instantly accessible, and when closed a housing protects it.

In addition to recording the temperature on the chart, an indicating scale is provided with large figures legible at a considerable distance. The chart has rectangular co-

ordinates. The time lines are straight across the chart and not curved. The recorder is driven by an electric clock if alternating current is available. Six recorders only consume the current required by a 25-watt incandescent lamp. The electric clock eliminates hand winding and no governor or other means is needed to secure accurate timing. Where alternating current is not available, a hand wound clock can be supplied.

The chart speed can readily be changed and is supplied for a number of combinations. The standard chart speed is one inch an hour but by reversing two gears, a speed of four inches per hour is obtainable. Speed combinations are available from ¼-in. an hour to 6-in. an hour.



The chart of the Brown recording pyrometer can be easily read

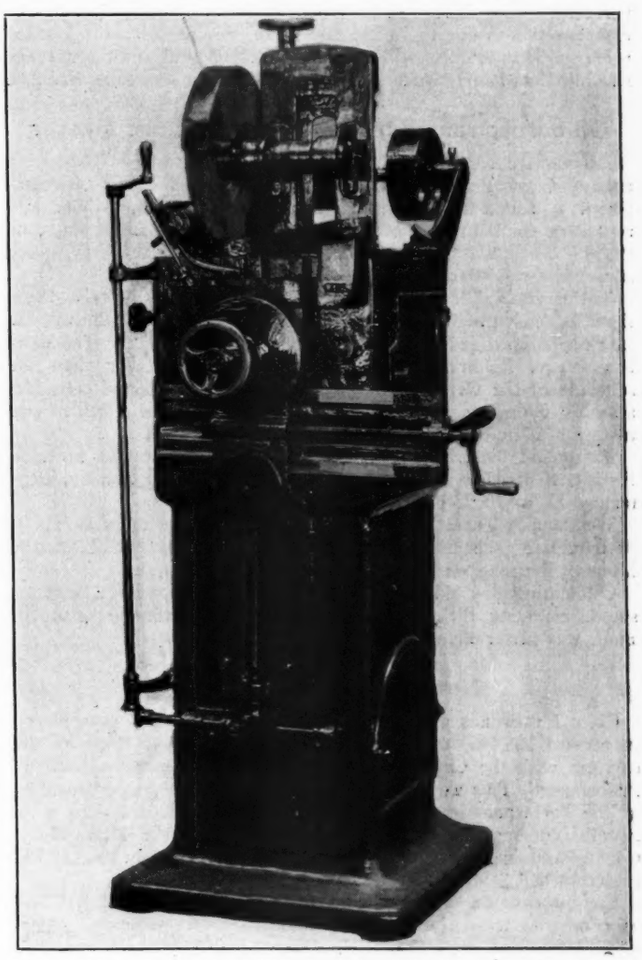
The instrument, as a pyrometer, incorporates an automatic cold junction compensation including the Brown patented index for adjusting a compensated pyrometer to the correct initial starting point on an open circuit.

As a multiple recorder, this instrument incorporates an automatic switch with gold contacts mounted on bakelite and immersed in oil, which prevents any possibility of tarnishing of the contacts from corrosive gases in the atmosphere. The multiple recorder switch includes a dial with an index for indicating the number of the thermocouple or furnace which is being recorded at the time. The record lines are made in different color combinations on the chart and the switch dial is numbered and colored to correspond.

Automatic circular saw sharpener

NOS. 11 and 12 circular saw sharpeners manufactured by the Machinery Company of America, Big Rapids, Mich., embody a type of grinder construction for automatically sharpening, gumming and retoothing medium sized metal cutting saws from 8 to 20 and 8 to 54 in. in diameter. These machines are automatic in their movements and when adjusted to the saw to be retoothed or sharpened may be put in operation and left practically unattended until the work is completed—the saw teeth perfectly sharpened, new teeth cut in if desired, and the saw ready for service. These results are obtained whether the saw is only slightly worn or dulled or is badly damaged. When automatically sharpening the teeth of a dull saw or in grinding in entirely new teeth, these machines will back off the teeth on the same principle as a milling cutter, thereby making a stronger tooth and one that will cut faster than the ordinary V-shape tooth.

The machines are equipped with an index feed so that the feeding and grinding of the saw teeth will not be subject to any unevenness from any uneven, worn or broken condition of the teeth to be ground. With the index feed, perfect sharpening and grinding of the teeth is insured regardless of the condition of the teeth to be ground. Thus, a blank steel plate with no sign of teeth remaining or with broken remnants of teeth will be taken by one of these machines and automatically made into a saw with correct teeth of any desired shape and spacing. This work will be done automatically with no attention from the operator from the time the blank steel plate is placed on the machine until it is ready to be taken off as a completed saw, further than an occasional dressing of the grinding wheel or turn of the handwheel to adjust the grinding wheel closer to the work.



No. 12 automatic saw sharpener for cutting saws 8 to 54 in. in diameter

The machines are fully automatic throughout, with a heavy solid cabinet frame construction, compact and rigidly supported, with the main working parts (aside from the grinding wheel head and drive pulleys) entirely enclosed in the body, fully protected from all dust, dirt and other foreign matter. The main working parts are provided with ample adjustments for taking up wear and insuring accuracy of action and durable service.

General News

Wage statistics for July

Class I railroads reported to the Interstate Commerce Commission a total of 1,795,669 employees for the month of July, 1925, an increase of 13,973 over the returns for the previous month. The total compensation increased $5,641,770, or 2.4 per cent. The difference in the percentage increase in employment and compensation is due to an increase in the average number of hours worked per employee. Compared with last year, employment shows an increase of 1.3 per cent, while the total compensation increased 3.9 per cent. The percentage difference between the employment and compensation is due to an increase in the number of hours worked per employee coupled with an increase of 5 mills in the average straight time hourly earnings, and 9 mills in the overtime earnings.

Oil-burner runs 3,700 miles with but one layover

Locomotive No. 2517, of the Great Northern, a new oil-burning engine, Class P-2, on Wednesday morning, September 30, completed a round-trip, Seattle, Wash., to St. Paul, Minn., and return—a total distance of 3,571 miles—in less than five days, or 99 hrs. 51 min. Thirteen different enginemen, each way, were successively in charge.

The eastbound train was a special, consisting of 19 cars, 18 of them loaded with silk; and the westbound was No. 27, the regular fast mail, scheduled to run through in 47 hrs. 30 min. The eastbound run, 52 hrs. 25 min., was five hours shorter than the schedule of the Oriental Limited, and on the westbound considerable lost time was made up. With the 19-car train a helper was used for 18 miles ascending the Rocky Mountains.

Eastbound the train left Seattle at 4:30 p. m., Pacific time, on Friday, September 25, and arrived at St. Paul on Sunday, September 27, at 10:55 p. m., Central time.

Westbound, Train 27 left St. Paul on Monday morning about 20 min. late (scheduled to leave at 8:45), and arrived at Seattle, Monday morning on time (6:15 a. m., Pacific time).

Calculating the distance at 3,600 miles, the average rate of speed, including the nine or ten hours in the roundhouse at St. Paul, was better than 32 miles an hour.

New cars and locomotives

Class I railroads during the first eight months this year placed in service 105,446 freight cars, according to reports filed by the carriers with the Car Service Division of the American Railway Association. This was an increase of 490 over the number installed in the corresponding period last year but 10,671 less than were installed during the same period in 1923. Of the total, 11,577 were placed in service in August, including 3,519 box cars, 6,730 coal cars and 269 refrigerator cars.

Freight cars on order on September 1 this year totaled 20,863 as compared with 41,476 on the same date last year and 72,906 in 1923.

Class I railroads during the first eight months in 1925 also placed in service 1,213 steam locomotives, as compared with 1,497 during the same period last year and 2,583 during the corresponding period in 1923. The same roads on September 1, 1925, had 193 locomotives on order, compared with 324 on the same day last year and 1,517 two years ago. During the month of August, this year, 147 locomotives were installed in service. These figures include new, rebuilt and leased equipment.

Strike of enginemen and firemen on the Western Maryland

The enginemen and firemen of the Western Maryland went on strike on October 15, 1925. The movement is said to be participated in by between 400 and 500 men, but it appears that complete passenger train service is being maintained and the officers of the road declare that a considerable percentage of the freight traffic is being moved. Published statements give little information about the real details of the difference between employer and employees, but an increase of five per cent in wages, said to be necessary to make the rates correspond to those which have been adopted by the New York Central Lines, appears to be the main point of dissension. The dispute was taken up by the Railroad Labor Board on its own motion on October 16. On October 21 the Labor Board directed the company and leaders of the brotherhoods to resume the conferences, looking to the termination of the strike, declaring that both sides ought to make concessions. This action of the Board was unanimous.

The officers of the company denied the public statement that the road had disobeyed an order of the Railroad Labor Board. The road has asked the Labor Board to dismiss the case asserting that service is not suffering, passenger service is being maintained 100 per cent and freight service approaching this ratio. This motion has been taken in advisement.

Lackawanna purchases new shop equipment

The Delaware, Lackawanna & Western has purchased the following new machine tools for which the installation has recently been completed in its various shops:

SECAUCUS, N. J., CAR SHOP
- Iron frame standard rip saw and table.

KINGSLAND, N. J., LOCOMOTIVE SHOP
- Tilting reverberatory melting furnace.
- Superheater pneumatic flue welding machine.
- Flue welding furnace for preheating and welding superheater tubes.
- Combination hot saw and tube expander.

SCRANTON, PA., LOCOMOTIVE SHOP
- 90-in. locomotive axle journal turning lathe.
- 86-in. heavy duty face grinder.
- 11-in. by 5-ft. heavy duty lathe.
- 72-in. plain right line radial drill.
- 16-in. by 40-in. by 120-in. piston rod grinder.
- Flat turret lathe.
- Drill grinding machine.
- Universal and tool grinding machine.
- 32-in. heavy duty shaper.
- Universal saw bench.
- 4-in. pipe threading and cutting machine.
- Blacksmith hammer.
- Universal grinding machine.

SCRANTON, PA., ENGINEHOUSE
- Electric arc welder, portable type.

HAMPTON, PA. (SCRANTON, PA.), ENGINEHOUSE
- Single spindle high speed sensitive drill press.

KINGSTON, PA., ENGINEHOUSE
- 50-ton vertical hydraulic forcing, bushing and bending press.

KEYSER VALLEY (SCRANTON, PA.), CAR SHOP
- Single spindle high speed sensitive drill press.
- 2-spindle friezing and shaping machine.

Locomotive repair situation

Date, 1925	No. locomotives on line	No. serviceable	No. stored serviceable	No. req. classified repairs	Per cent	No. req. running repairs	Per cent	Total req. repairs	Per cent
January 1	64,384	53,118	4,849	5,927	9.2	5,339	8.3	11,266	17.5
February 1	64,308	52,994	4,220	6,143	9.6	5,171	8.0	11,314	17.6
March 1	64,255	52,851	4,988	6,217	9.7	5,187	8.0	11,404	17.7
April 1	64,230	52,619	6,241	6,345	9.9	5,266	8.2	11,611	18.1
May 1	64,034	52,933	6,697	6,082	9.5	5,019	7.8	11,101	17.3
June 1	63,976	53,074	6,618	5,916	9.2	4,986	7.8	10,902	17.0
July 1	63,942	53,025	6,600	5,832	9.1	5,085	8.0	10,917	17.1
August 1	63,921	53,263	6,313	5,740	9.0	4,918	7.7	10,658	16.7
September 1	63,812	53,261	5,902	5,514	8.6	5,037	7.9	10,551	16.5

Data from Car Service Division reports.

48-in. by 21-in. compression type pneumatic yoke riveter.
4-in. heading, upsetting and forging machine.
Blue-printing machine.
Power brake.
Power shear.
Car type annealing furnace.

EAST BUFFALO, N. Y., LOCOMOTIVE SHOPS
60-in. by 60-in. by 12-ft. metal planer.
2¼-in. by 24-in. flat turret lathe.
84-in. heavy vertical boring and turning mill.
62-in. horizontal boring and drilling machine.
36-in. heavy duty, new type railroad draw-cut shaper.
11-in. by 5-ft. heavy duty lathe.

GRAVEL PLACE, PA., ENGINEHOUSE
12½-ton locomotive crane.

All of these machine tools are motor driven and are provided with push button control.

The 90-in. journal turning and quartering machine installed in the locomotive shops at Scranton is equipped with a counterbalancing device which permits the counterbalancing of wheels in the lathe with little effort and insures accuracy in the turning of journals. This machine is also equipped to turn journals on main crank axles for three-cylinder locomotives and for quartering driving wheels for both two and three-cylinder locomotives. It is estimated that a machine of this type will handle the work of a locomotive shop which has an output of approximately 30 locomotives a month and keep up with the production of the other departments. The 36-in. draw-cut shaper installed in the erecting shop at East Buffalo is a heavy production machine and was secured for machining the back and front end main rod brasses, planing shoes and wedges after being laid out and for slotting and planing cast steel driving boxes. It is expected that this machine, which has been assigned to this special work, will secure increased production due to its high power and adaptability for this particular class of work.

Locomotives installed and retired

Month—1925	Installed during month	Aggregate tractive effort	Retired during month	Aggregate tractive effort	Owned at end of month	Aggregate tractive effort
January	167	7,455,971	213	6,242,079	64,824	2,590,525,478
February	125	6,233,494	169	5,118,878	64,779	2,591,618,849
March	138	6,249,721	170	4,888,933	64,747	2,592,979,637
April	171	7,498,252	409	13,126,135	64,509	2,587,347,354
May	147	7,930,840	172	5,329,461	64,484	2,589,912,779
June	179	9,746,100	224	8,296,659	64,435	2,591,286,720
July	139	7,208,534	170	5,602,619	64,420	2,593,971,635
August	147	8,384,262	210	5,866,368	64,357	2,596,489,549
Total for 8 months	1,213	.....	...	.....	.....	.....

Figures as to installations and retirements prepared by Car Service Division, A. R. A., published in Form C. S. 56A-1. Figures cover only those roads reporting to the Car Service Division. Figures of installations and retirements alike include also equipment rebuilt to an extent sufficiently so that under the accounting rules it must be retired and entered in the equipment statement as new equipment.

Freight cars installed and retired

	Installed during month	Aggregate capacity tons	Retired during month	Aggregate capacity tons	Owned at end of month	Aggregate capacity tons
January, 1925	11,768	551,263	7,867	326,812	2,341,109	103,812,974
February	15,024	721,867	9,453	365,111	2,346,687	104,169,525
March	16,007	753,947	12,067	474,644	2,350,697	104,454,128
April	13,749	652,462	10,497	423,322	2,353,956	104,683,798
May	12,982	612,607	8,658	335,401	2,356,641	104,902,235
June	12,191	590,657	9,797	365,589	2,359,040	105,127,861
July	10,542	504,185	10,051	384,084	2,361,551	105,350,472
August	11,554	564,681	9,259	364,487	2,363,849	105,550,765
Total for 8 months	103,817	.....	.....	.....	.....	.....

Figures as to installations and retirements prepared by Car Service Division A. R. A. Figures cover only those roads reporting to the Car Service Division. Figures of installations and retirements alike include equipment rebuilt to an extent sufficiently so that under the accounting rules it must be retired and entered in the equipment statement as new equipment.

Meetings and Conventions

Tentative program announced for the annual meeting of the A. S. M. E.

A tentative program has been arranged for the annual meeting of the American Society of Mechanical Engineers which is to be held at the Engineering Societies building, 29 West Thirty-ninth street, New York, November 30 to December 4, 1925. The sessions begin at 9:30 a. m. on Monday, November 30, with a meeting of the council followed by a conference of the delegates from the local sections. At 2 p. m. the council and local sections delegates reconvene, and there is also scheduled a meeting of the main Committee on Power Test Codes. An open house for all in attendance at the convention is scheduled for that evening.

The program contains a number of subjects which will be of special interest to railway mechanical department officers. The Railroad Division meets on Tuesday, December 1, at 2 p. m., at which time there will be papers presented on locomotive boilers and on car design, the authors of which are yet to be announced. Sessions of interest to mechanical engineers engaged in railroad work are given in the tentative program as follows:

TUESDAY, DECEMBER 1

9:30 a. m.—Oil and Gas Power Division
Machine Shop Practice Division (I)
2:00 p. m.—Railroad Division
4:30 p. m.—Henry Robinson Towne lecture on engineering and economics, by the Hon. Herbert Hoover
EVENING—Award of honorary memberships to the Hon. Herbert Hoover and Worcester R. Warner, past president, A. S. M. E.
Presidential address and reception

WEDNESDAY, DECEMBER 2

9:30 a. m.—Industrial Furnaces (Fuels Division)
Materials Handling Division
Machine Shop Practice Division (II)
Springs (Special Research Committee on Metal Springs)
Luncheon of council and student branch delegates
2:00 p. m.—General
Annual report of council
Award of Charles T. Main, junior and student prizes
Report of A. S. M. E. investigation for S. P. E. E. on mechanical engineering education
Progress reports of A. S. M. E. professional division
Education and training for the industries of non-college type (Committee on Education and Training for the Industries)
Steam tables research
Student branch conference
Ladies tea and reception
EVENING—Annual dinner at Hotel Astor

THURSDAY, DECEMBER 3

9:30 a. m.—Steam power (Power Division)
Management Division
Aeronautic Division
2:00 p. m.—Power Plant Materials (Power Division)
Industrial Psychology
Lubrication (Special Research Committee on Lubrication)
Robert Henry Thurston lecture on engineering and science, by Dr. Zay Jeffries
EVENING—National Defense Division

FRIDAY, DECEMBER 4

Council and committee meetings
Excursions

Power and mechanical engineering exposition

The fourth national exposition of Power & Mechanical Engineering will open at 2 p. m. on Monday, November 30, at the Grand Central Palace, New York City, and will extend through the week ending December 5. The basic purpose of the exposition is to bring together showings of manufacturers of power and mechanical equipment so that engineers and industrial executives may have an opportunity for comparative study of the outstanding developments in the field. Devices to increase the effectiveness and economy of combustion and machine tools and equipment used in machine shop practice will be main features of the exhibit.

Freight car repair situation

1925	Number freight cars on line	Cars awaiting repairs: Heavy	Light	Total	Per cent of cars awaiting repairs
January 1	2,293,487	143,962	47,017	190,979	8.3
February 1	2,305,520	139,056	47,483	186,539	8.1
March 1	2,313,092	141,192	43,855	185,047	8.0
April 1	2,315,732	143,329	43,088	186,417	8.1
May 1	2,316,561	144,047	45,467	189,514	8.2
June 1	2,320,261	146,998	48,988	195,986	8.4
July 1	2,326,734	150,530	47,938	198,468	8.5
August 1	2,335,223	153,674	43,607	197,281	8.4
September 1	2,333,849	149,705	47,473	197,178	8.4

1925	Cars repaired: Heavy	Light	Total
January	69,084	1,358,308	1,427,392
February	66,283	1,313,088	1,379,371
March	71,072	1,348,078	1,419,150
April	69,631	1,290,943	1,360,574
May	65,651	1,276,826	1,342,477
June	71,789	1,296,558	1,368,347
July	70,087	1,330,595	1,401,682
August	71,307	1,369,878	1,441,185

Data from Car Service Division Reports.

June Mechanical convention

After a joint meeting of the General Committee of Division V—Mechanical, American Railway Association, and the executive committee of the Railway Supply Manufacturers' Association, held in Philadelphia, October 13, it was decided to hold the annual convention of Division V and the R. S. M. A. exhibit on Young's Million Dollar Pier at Atlantic City, N. J., June 9-16, inclusive. In all probability Division VI—Purchases and Stores, A. R. A., will hold its annual convention at Atlantic City at the same time.

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs.

AIR-BRAKE ASSOCIATION.—F. M. Nellis, Room 3014, 165 Broadway, New York City.

AMERICAN RAILROAD MASTER TINNERS', COPPERSMITHS' AND PIPEFITTERS' ASSOCIATION.—C. Borcherdt, 202 North Hamlin Ave., Chicago.

AMERICAN RAILWAY ASSOCIATION, DIVISION V.—MECHANICAL—V. R. Hawthorne, 431 South Dearborn St., Chicago. Next meeting June 9-16, inclusive, Young's Million Dollar Pier, Atlantic City, N. J.

DIVISION V.—EQUIPMENT PAINTING SECTION.—V. R. Hawthorne, Chicago.

DIVISION VI.—PURCHASES AND STORES.—W. J. Farrell, 30 Vesey St., New York.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—G. G. Macina, 11402 Calumet Ave., Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth St., New York. Railroad Division, A. F. Steubing, Bradford Corp., 25 West Forty-third St., New York.

AMERICAN SOCIETY FOR STEEL TREATING.—W. H. Eiseman, 4600 Prospect Ave., Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS.—C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Joseph A. Andreucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill.

CANADIAN RAILWAY CLUB.—C. R. Crook, 129 Charron St., Montreal, Que. Regular meetings second Tuesday in each month, except June, July and August, at Windsor Hotel, Montreal, Que. Next meeting, November 10. Paper on Analysis of Shop Output and Costs will be presented by J. W. Kennedy, general supervisor production department, Canadian Pacific, Montreal.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 626 N. Pine Ave., Chicago, Ill. Meeting second Monday in month, except June, July and August, Great Northern Hotel, Chicago, Ill.

CAR FOREMEN'S ASSOCIATION OF ST. LOUIS.—R. E. Giger, 721 North 23rd St., E. St. Louis, Ill. Meetings, first Tuesday in month, except June, July and August, at the American Hotel Annex, St. Louis.

CAR FOREMEN'S CLUB OF LOS ANGELES.—J. W. Krause, 514 East Eighth St. Los Angeles, Cal. Meeting second Friday of each month in the Pacific Electric Club Building, Los Angeles, Cal.

CENTRAL RAILWAY CLUB.—H. D. Vought, 26 Cortlandt St., New York, N. Y. Regular meetings, second Thursday each month, Hotel Statler, Buffalo, N. Y. Next meeting, November 12. Paper on main tracking of freight trains will be presented by D. W. Dinan, assistant general manager of the New York Central, Syracuse, N. Y.

CHIEF INTERCHANGE CAR INSPECTORS' AND CAR FOREMEN'S ASSOCIATION.—A. S. Sternberg, Belt Railway, Clearing Station, Chicago.

CINCINNATI RAILWAY CLUB.—W. C. Cooder, Union Central Building, Cincinnati, Ohio. Meetings, second Tuesday, February, May, September and November. Next meeting November 18. Paper on General Railroad conditions will be read by C. A. Radford, publicity agent. Big Four Route. Annual meeting, election of officers and turkey dinner.

CLEVELAND STEAM RAILWAY CLUB.—F. L. Frericks, 14416 Adler Ave., Cleveland, Ohio. Meetings first Monday each month except July, August and September, at Hotel Cleveland, Public Square, Cleveland.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.—W. J. Mayer, Michigan Central, 2347 Clark Ave., Detroit, Mich.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—J. B. Hutchison, 1809 Capitol Ave., Omaha, Neb. Next meeting May 11-14, 1926, Hotel Sherman, Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabash Ave., Winona, Minn.

MASTER BOILERMAKERS' ASSOCIATION.—Harry D. Vought, 26 Cortlandt St., New York. Next Meeting May 25-28, 1926, Hotel Statler, Buffalo, N. Y.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass. Regular meeting second Tuesday in month, except June, July, August and September. Copley-Plaza Hotel, Boston, Mass. Next meeting November 10. Paper on Activities of the American Railway Engineering Association will be presented by J. E. Armstrong, assistant engineer, Canadian National.

NEW YORK RAILROAD CLUB.—H. D. Vought, 26 Cortlandt St., New York. Meeting third Friday each month, except June, July and August, at 29 West Thirty-ninth St., New York.

NIAGARA FRONTIER CAR MEN'S ASSOCIATION.—George A. J. Hochgreb, 625 Brisbane Building, Buffalo, N. Y. Regular meetings, January, March, May, September and October.

PACIFIC RAILWAY CLUB.—W. S. Wollner, 64 Pine St., San Francisco, Cal. Regular meetings, second Thursday of each month in San Francisco and Oakland, Cal., alternately. Next meeting November 12 at Hotel Oakland, Oakland. Associate members night. Papers on the relation of the supply industry to the roads, selling the railroads and the service of the service engineer will be presented.

RAILWAY CLUB OF GREENVILLE.—F. D. Castor, clerk, maintenance of way department, Bessemer & Lake Erie, Greenville, Pa. Meeting last Friday of each month, except June, July and August.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 515 Grandview Ave., Pittsburgh, Pa. Regular meeting fourth Thursday in month, except June, July and August. Fort Pitt Hotel, Pittsburgh, Pa.

ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo. Regular meetings, second Friday in each month, except June, July and August.

SOUTHEASTERN CARMEN'S INTERCHANGE ASSOCIATION.—J. E. Rubley, Southern Railway shops, Atlanta, Ga.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, 1177 East Ninety-eighth St., Cleveland, Ohio.

WESTERN RAILWAY CLUB.—Bruce V. Crandall, 226 W. Jackson Blvd., Chicago. Regular meetings, third Monday in each month, except June, July and August.

Supply Trade Notes

The Southern Wheel Company, Pittsburgh, Pa., is contemplating the construction of a plant in St. Louis, Mo.

V. B. Emrick has been appointed a representative of the Locomotive Stoker Company, with headquarters at Chicago.

The Harnischfeger Corporation, Milwaukee, Wis., plans the construction of an addition to its plant at 38th street and National avenue.

J. P. Carney, for the past 13 years general car inspector of the Michigan Central, with headquarters at Detroit, Mich., has joined the sales force of the Grip Nut Company.

C. W. Owsley has been appointed district manager, railway department, at New York, of the E. I. du Pont de Nemours & Co., Inc., in the paint and varnish division, specializing in the Duco products.

The General American Tank Car Corporation, Chicago, has established southern sales offices in New Orleans, La., at 1022 Union Indemnity building, in charge of Z. R. Simon, southern sales manager.

A. A. Helwig, superintendent car department of the Kansas City Terminal, has joined the sales organization of the Bradford Corporation, New York. Mr. Helwig will have his headquarters at St. Louis, Mo.

Joseph T. Ryerson & Son, Chicago, has acquired full rights covering the manufacture and sale of the horizontal drilling and boring machines heretofore manufactured and sold by the Harnischfeger Corporation, Milwaukee, Wis.

The Boss Bolt & Nut Works Division of the Hoopes & Townsend Corporation, Philadelphia, Pa., has been organized through the consolidation of the American Bolt Corporation, New York, and the Hoopes & Townsend Company, Philadelphia.

The Standard Steel Car Company has awarded a general contract to the Austin Company, Cleveland, Ohio, for a one-story addition, 80 ft. by 335 ft., and improvements to its present shop at Hammond, Ind., to cost approximately $200,000 with equipment.

G. R. Ingersoll, of the Associated Materials Company, with officers at 935 Schofield building, Cleveland, Ohio, has been appointed representative of the Morton Manufacturing Company, Chicago, to handle the sale of this company's products throughout the Cleveland district.

E. Thomann, managing director of the railroad department of Brown, Boveri & Co., Ltd., of Baden, Switzerland, and A. Buchli, executive director of the Swiss Locomotive Works, at Winterthur, affiliated with the former company, have arrived in this country to inspect various systems of railroad electrification in operation here. The Brown Boveri Company expects soon to enter actively into the manufacture in America of electrical equipment, including electric locomotives, through an American company now in process of organization.

The Air Preheater Corporation, 25 Broadway, New York, manufacturers of the Ljungstrom Air Preheater, is a consolidation of James Howden & Co. of America, Inc., and the Ljungstrom interests of Stockholm, Sweden. The newly formed corporation takes over all Ljungstrom patent rights of the preheater, together with the shops of James Howden & Co. of America, Inc., at Wellsville, N. Y. B. G. Brolinson has been elected president of the Air Preheater Corporation. W. L. Batt, president of S K F Industries, is chairman of the board of directors.

J. H. Williams & Co., Buffalo, N. Y., has just introduced a new line of wrenches made from chrome-molybdenum steel. These tools, known as the Superrench, will supplement the Superior drop forged wrenches of carbon steel, the chrome-molybdenum steel providing a stronger and tougher material with a decrease in weight impossible of attainment with carbon steel. These tools are available in four styles, all heat treated: Engineers' pattern, double head, 15 deg. angle openings—a wrench with thinner and narrower jaws and of generous length; general

service "S" pattern, long and light with unusual leverage; construction pattern, single head, 15 deg. angle opening; structural pattern, single head, straight opening, offset handle.

At a recent meeting of the board of directors of the Westinghouse Electric & Manufacturing Company, Richard B. Mellon, of Pittsburgh, Pa., was elected a director, to fill the vacancy caused by the death of William McConway. Edward D. Kilburn and Walter S. Rugg were recently elected vice-presidents of the company; Mr. Kilburn and Mr. Rugg have been connected with the Westinghouse company for many years. Vice-president W. S. Rugg will take over the direction of Westinghouse engineering activities and vice-president and general sales manager E. D. Kilburn will direct the sales activities as arranged by F. A. Merrick, vice-president and general manager. Mr. Kilburn retains his office of vice-president of the Westinghouse Electric International Company. H. D. Shute, vice-president, will retain his direction of the commercial activities of the company including especially customer relationships, and H. P. Davis, vice-president, formerly in charge of engineering and manufacturing activities as applying to the strictly electrical portions of the company's business, will in future have direction over the entire manufacturing activities of the company and of the general features of the radio business including broadcasting. The duties of the other vice-presidents of the company remain unchanged.

The American Foreign Sales Corporation, a recent incorporation with office at 150 Broadway, New York City, has elected W. G. Kaylor president, and G. A. Smith secretary and treasurer. The directors include the two officers above and F. A. Schaff, vice-president of the Superheater Company; C. S. Sale, executive department, American Car & Foundry Company; Rodney Hitt, of Hitt, Farwell & Company, and Samuel A. Pleasants, of Marvin & Pleasants. The company was organized to promote the sale in foreign markets of American products and is well equipped to handle sales in foreign countries of American railway supplies and equipment. W. G. Kaylor was formerly manager for the Orient for the Westinghouse Air Brake Company and associated companies. Mr. Kaylor was born on April 18, 1883, at Indianapolis, Ind., and graduated as a mechanical engineer from Purdue university in the class of 1905. In 1908 he received a masters degree in mechanical engineering from the same university. Shortly after graduation he entered the service of the Westinghouse Air Brake Company as a special apprentice at Wilmerding, Pa. He subsequently was engaged in installing air brakes on the New York Central's all-steel passenger cars. In 1907 he was instructor of motormen and engineers in the operation of electrified cars and locomotives on the New York Central and the New York, New Haven & Hartford operating out of New York City. In 1911 he was engaged in commercial engineering work for the Westinghouse Air Brake Company at New York. He also had charge of the company's export department and for about a year represented the company in South America. Subsequently he represented the Air Brake Company and associated companies as manager for the Orient, with office in Tokio, Japan, and served in that capacity until November, 1924.

Brake shoe testing machine in the railway engineering laboratories at the University of Illinois

Trade Publications

RELIANCE MOTORS.—Ball and roller bearing reliance motors for direct and alternating current are described and illustrated in Bulletin No. 4000 issued by the Reliance Electric & Engineering Company, Cleveland, Ohio.

LEATHER BELTING.—A non-technical summary of research on the applications of leather belting as compiled by the Leather Belting Exchange Foundation, Cornell University, has been issued in booklet form by the Chas. A. Schieren Company, New York.

STEEL FILLER RODS.—The properties of iron or steel filler rods for both gas and metallic arc welding are described in a 28-page booklet issued by the Chicago Steel & Wire Company, Chicago, Ill. Many questions which have hitherto perplexed those interested in fusion welding are answered in this booklet.

CHUCKS.—The Union Manufacturing Company, New Britain, Conn., has issued a 64-page illustrated catalogue descriptive of its line of chucks, which includes combination, universal independent, geared scroll, scroll combination, planer, boring mill, car wheel, grinding machine, box body, round body and drill chucks.

MILLING CUTTERS.—The Goddard & Goddard Company, Detroit, Mich., has recently brought out a catalogue on milling cutters and their uses, which is devoted exclusively to milling cutters adaptable for use in railroad shop work. Complete descriptions and specifications of the various types of cutters, as well as information pertaining to the particular class of work for which they are designed, is contained in this 96-page catalogue.

ELECTRO-MECHANICAL HAMMER.—The Kango electro-mechanical hammer, which is of a light chipping, caulking and scaling type, for use on metal, stone, wood or other material, is described and illustrated in a 12-page brochure issued by the Kango Company, Ltd., London, England. This hammer consists of a cylindrical casing fitted at the upper end with a stirrup-shaped handle, through which is led the cable for the motor and in which is situated the trigger switch.

ELECTRIC RIVET HEATERS.—American electric rivet heaters and shop appliances are described and illustrated in a 16-page booklet issued by the American Hoist & Derrick Company, St. Paul, Minn. A seven-day comparison of the results obtained with an American electric rivet heater and an ordinary oil furnace appears in the booklet in tabular form, the sizes, numbers of rivets and weights being given, also the current consumption for the electric heater and the oil consumption for the oil heater.

AGATHON ALLOY STEELS.—The Central Steel Company, Massillon, Ohio, has gotten up a handy disk of celluloid construction for the use of those who are engaged in the heat treatment of alloy steels. By turning the slide on one side of the disk to the grade number, the composition of that particular grade is obtained and also a reference letter referring to the proper treatment is given. By turning the slide on the opposite side of the disk to the reference letter, data as to the proper heat treatment can be obtained.

THE FOUR-WHEEL TRAILER TRUCK.—Under the title of "The Locomotive Four-Wheel Articulated Back End," the American Arch Company, Inc., New York, has issued an eight-page pamphlet describing the articulated four-wheel trailer truck of the type used under the Lima 2-8-4 type locomotive, first placed in service on the Boston & Albany, and setting forth the advantages of the large grate area the four-wheel truck makes possible in improving combustion and boiler efficiency. The truck is sold under patents controlled by the American Arch Company.

LOCOMOTIVE SUPERHEATERS.—The Superheater Company, New York, has issued the fourth edition of its Instruction Book on the locomotive superheater, giving instructions for installation, operation, maintenance and repairs. This book supersedes the edition issued in 1917 and contains 87, 4½-in. by 6-in. pages. It has been completely revised and gives the latest recommendations relative to the installation, operation and maintenance of the Elesco Type A superheater. Questions and answers in the back of the book cover the principle of superheating generally. The subject matter is well supplemented with illustrations.

Personal Mention

Master Mechanics and Road Foremen

H. Y. Harris has been appointed master mechanic of the Seaboard Air Line, with headquarters at Tampa, Fla.

E. J. English has been transferred as master mechanic of the Great Northern at Minot, N. D., to Everett, Wash.

W. A. King has been appointed road foreman of engines of the Seaboard Air Line, with headquarters at Wildwood, Fla.

F. B. Moss has been appointed master mechanic of the Richmond division of the Chesapeake & Ohio, with headquarters at Richmond, Va.

S. G. Clark, formerly traveling engineer of the Great Northern at Havre, Mont., has been promoted to master mechanic, with headquarters at Minot, N. D.

Robert G. McKee has been appointed master mechanic of the Chicago division of the Chesapeake & Ohio, with headquarters at Peru, Ind., succeeding E. R. Woody, who has been transferred to another point and assigned to other duties. Mr. McKee was born on April 20, 1885, at Rockbridge Co., Va. He attended the public schools at Bueno Vista, Va., and on May 1, 1903, entered the employ of the American Locomotive Works as a machinist apprentice. On March 5, 1904, he entered the Seventeenth Street shops of the Chesapeake & Ohio, and on August 5, 1904, was transferred to Clifton Forge, Va., completing his apprenticeship on July 15, 1907. From the latter date until January 1, 1913, he served as machinist and shop draftsman. He then entered the employ of the Baltimore & Ohio as a gang foreman at the Mt. Clare shops, Baltimore, Md., on October 1, 1913, returning to the C. & O. shops at Clifton Forge as shop draftsman and apprentice instructor. On January 20, 1914, he was promoted to gang foreman, and on May 1, 1916, transferred to Peru, Ind., as general foreman. On May 16, 1923, he was transferred to the Huntington shops where he remained until his appointment as noted above.

R. G. McKee

Shop and Enginehouse

L. F. Fife has been promoted to general foreman, motive power department, of the Southern Pacific, with headquarters at Sparks, Nev.

B. F. Madden has been promoted to the position of departmental foreman of the Southern Pacific shops at Sparks, Nev., succeeding L. F. Fife.

William A. Schipper has been promoted to machinist foreman of the Southern Pacific, with headquarters at Sparks, Nev., succeeding B. F. Madden.

J. O. McCann has been appointed boiler foreman of the Chicago & Alton, with headquarters at Slater, Mo.

W. H. Davis, acting night foreman of the Kansas City Southern, at Port Arthur, Tex., has been permanently promoted to that position.

W. H. Dillon has been appointed machine shop foreman of the Chicago & Alton, with headquarters at Slater, Mo.

W. J. Taylor, general foreman of the shops of the Southern Pacific at Sparks, Nev., has been transferred as general foreman to Sacramento, Cal.

J. R. Zeurick, general boiler foreman of the Baltimore & Ohio at the Ivorydale shops of the Baltimore & Ohio at Cincinnati, Ohio, has been promoted to general foreman, with headquarters at Flora, Ill.

Purchasing and Stores

A. N. Warner has been appointed storekeeper of the Great Northern, with headquarters at Breckenridge, Minn.

R. S. Simmons has been appointed storekeeper of the Great Northern, with headquarters at Williston, N. D., succeeding A. N. Warner.

G. F. Ohden has been appointed division storekeeper of the Illinois Central, with headquarters at Water Valley, Miss., succeeding W. E. Hoyt, deceased.

W. L. Wheeler has been appointed assistant general storekeeper of the Chicago & North Western, with headquarters at Chicago, succeeding D. W. Corcoran.

O. A. Donegan has been appointed general storekeeper of the Boston & Maine, with headquarters at Boston, Mass., succeeding J. E. Byron, who has been assigned to other duties.

D. W. Corcoran, assistant general storekeeper of the Chicago & North Western, with headquarters at Chicago, has been promoted to general storekeeper, with the same headquarters, succeeding R. M. Blackburn, who has resigned.

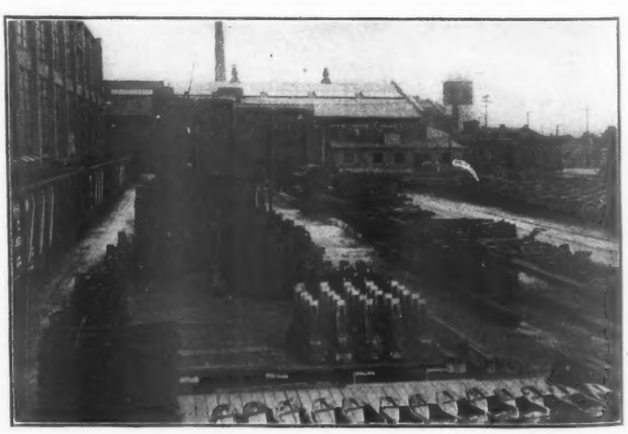
Car Department

F. M. Darden, assistant car foreman of the St. Louis-San Francisco, with headquarters at Springfield, Mo., has been appointed general car foreman of the west freight shop, with the same headquarters, to succeed G. W. Thomas, resigned.

Promotion of Sir Henry Fowler

Sir Henry Fowler, K. B. E., has been promoted from deputy mechanical engineer to chief mechanical engineer of the London, Midland & Scottish Railway, succeeding George Hughes, who retires. The news of Sir Henry Fowler's promotion will be of interest to numerous persons in the United States. During the war he was superintendent of The Royal Aircraft Factories for the British government, and while serving in that position visited the United States. He was a joint general secretary of the recent International Railway Congress in London and was active in making and carrying out the arrangements of the British railways for the entertainment of the foreign visitors.

He was formerly chief mechanical engineer of the Midland Railway and became deputy chief mechanical engineer of the London, Midland & Scottish when the program of amalgamation of British railways was carried out, in accordance with which the London & North Western, Midland and some other lines were consolidated into the London, Midland & Scottish. He has been president of the Institution of Locomotive Engineers, of the Institution of Automobile Engineers and of the University of Birmingham Engineering Society.



Neatly arranged material yard for a car department